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MINERS' GUIDE

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CALIFORNIA WIRE WORKS

SAN FRANCISCO

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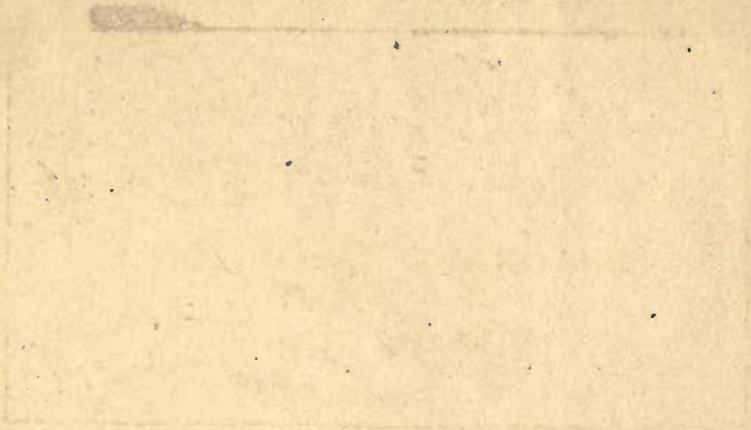

THE

MECHANICAL

MINERS' GUIDE

ISSUED BY THE

CALIFORNIA WIRE WORKS

SUCCESSORS TO

A. S. HALLIDIE

MANUFACTURERS OF

WIRE AND WIRE ROPE

AND THE

Four Pointed Steel Barb Fence Wire

Office: No. 6 CALIFORNIA ST.

SAN FRANCISCO, CALIFORNIA

1882

LIBRARY OF THE UNIVERSITY OF CALIFORNIA.

FOURTH EDITION

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NOTE.

The Scales, Tables and Rules contained in this pamphlet have been carefully compiled and coudensed from the best authorities, and care has been taken throughout to make use of only such as the requirements of the mechanic and miner call for.

The compiler for many years resided and worked in the mining region, and often felt the want of a small pamphlet containing the weight and strength of different materials; rules for calculating the velocity and power of water, etc., etc., and the strength and weight of ropes and chains and such general information.

It is offered with a full description and explanation of the use of Wire Rope, Wire Rope transportations, transmission of power by Wire Rope, Cable Railroads, etc., to those interested, trusting to meet their approbation.

CALIFORNIA WIRE WORKS

Successors to A. S HALLIDIE.

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Iron and Steel Wire Rope Works and Wire Mills

SAN FRANCISCO, CAL., 1882.

We are prepared to furnish the Mining, Manufacturing, Shipping and Ferry Interests on the Pacific Coast, with Iron and Steel Wire Rope of all kinds, in any length, size and quantity desired, from our manufactory in San Francisco, on favorable terms.

CALIFORNIA WIRE WORKS.

The adaption of Iron Wire to the manufacture of Ropes, is due to Mr. Andrew Smith, a civil engineer by profession, and a native of Dumfrieshie, in the south of Scotland. His first experiments were made in 1828. As a substitute for raw hide ropes, he employed as counterbalance ropes for shutters and elevators; and the partial success he met with was encouraged by the great advance in the price of Russian hemp. His first patent was dated January 12th, 1835; his second patent was dated March 26th, 1836. A third patent was granted him on December 21st, 1836, and a fourth patent was granted him March 20th, 1839; and at subsequent dates other patents were issued him for improvements in Wire Ropes and Wire Rope machinery. Since then Wire Rope has become an important industry, and has added much to the wealth of the country, in helping to develop the iron interests.

Wire Rope is now generally employed for Mining, Ferry, Shipping and general purposes; and forty years' experience has proved that it possesses many great advantages over Hempen Ropes—being lighter, stronger, more durable and cheaper than Hemp or Manila, and is not affected by atmospheric changes.

The many purposes to which Wire Rope has been applied where Hemp Rope would soon have been destroyed, and chain found too heavy, soon induced its general adoption throughout the mining regions of the civilized world, wherever shafts and incline planes are sunk to great depths; and the universal preference given to it over other ropes and chain, is a sufficient guarantee of its superiority. On the Pacific Coast, the consumption of rope for mining purposes is very great. Until the erection of our works in 1857,

Wire Rope was not in the market, although the requirements of the mining and shipping interests had long demanded it. This demand we have since been able to supply, and have recently remodeled our works with machinery of the most approved pattern, capable of turning out all kinds of Flat and Round Wire Rope, which we guarantee to be equal to any made.

Round Wire Ropes are made from charcoal iron, bessemer steel or refined crucible steel, galvanized or not, and of each of these, two kinds of Wire Rope are made, Coarse Rope having 42 wires, and Flexible Rope having 114 wires. The latter being used for hoisting, etc., when the sheaves or drums are of small diameter.

In addition to the Round Ropes, Flat Iron or Steel Wire Ropes are made from 2 inches to 10 inches wide, and from ¼ to 1¼ inches thick.

It is almost impossible to specify the precise uses to which Wire Rope is adapted in preference to hempen ropes or chain; but for the following purposes it has been a long time in use, and in every respect is much preferred:

For Hoisting from Deep Shafts and Incline Planes.

For Guy Ropes for Derricks.

For Pump Ropes for Driving River Machinery.

For Suspension Cables for Water Conduits or Aqueducts.

For Signal Cord.

For Ferry Ropes.

For Ships' Standing Rigging.

For Tiller Ropes for Steamers.

For Guy Ropes for Smoke Stacks.

For Sash Cord for Window Sashes, Hanging Pictures, etc.

For Power Ropes, for conveying power to any distance.

For Wire Tramways.

For Endless Wire Ropeway, for the transportation of material over mountainous and difficult roads, etc.

For Steam Cultivation and Land Tillage.

For Street Railroads.

For Ships' and Tugs' Hawsers.

For Thoroughbraces, etc., etc.

For Store and Hotel Elevators.

Lightning Conductors for the protection of Dwellings, Ships' Masts, etc.

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WIRE ROPE

General Remarks on Wire Rope.

The numerous purposes to which rope is applied, its great cost being a large item in a mining company's expenses, necessitates the use of economy in its application; therefore, when it is satisfactorily proved, that by the application of Wire instead of Hemp Ropes, a saving can be effected, it should be a guarantee of its general adoption.

When the machinery is properly arranged, and drums and pulleys properly proportioned, the durability of Wire Rope over the best quality of Hempen Ropes is as 3 to 1. But Wire Rope can be destroyed like other rope, if badly used; and as we do not claim for Wire Rope more than it deserves, the surest test is a fair trial; but we do claim for it the following advantages over other ropes, under a fair and legitimate trial:

1st.—It is less than two-thirds the weight of dry Hemp Rope.

2d.—It is but one-fourth the weight of a wet Hemp Rope.

3d.—It is less than one-half the size for same strength.

4th.—It does not stretch and shrink (being unaffected by the atmosphere), nor does it absorb moisture.

5th.—It is three to five times as durable.

6th.—The excessive heat of the Summer sun does not rot it, nor does the moisture of Winter cause it to swell.

7th.—It can be spliced as easily, wet or dry—frozen or otherwise—and more snugly and neatly than Hemp Rope.

8th.—And lastly—We do not have to send to Manila or Russia, or any other foreign country, for the raw material, but obtain it from the iron-fields of our own country, thus being essentially a home-manufactured article.

Wire rope is usually made of six strands, the core or heart around which it is formed being either hemp or wire; the former being preferred for hoisting ropes, or where the rope works around a sheave or draw. The strands are formed of six wires around a centre wire, thus giving in all 42 wires to the rope. This is the best form for a rope which has to work over sheaves and drums of large diameters, or in cases where the ropes are used as guys or stays.

When sheaves and drums of comparative small diameter are employed, then the strands are composed of much smaller wires, and usually nineteen wires form each strand, giving 114 wires to the rope, and making a very soft and flexible rope. The rigidity or flexibility of a rope is also modified as the wire is either soft or hard. For a rope of great tensile strength, hard drawn wire is required, but if it is necessary to have a rope of extreme softness and flexibility, annealed wire can be used; but it must be born in mind that wire loses 40 per cent. of its tensile strength by annealing. Refined Crucible Steel Wire largely combines both qualities of great tensile strength, flexibility and toughness.

The following are some of the Advantages of Wire Rope for Ships' Rigging, Etc.:

1. Wire Rope is not affected by the atmospheric changes, consequently does not stretch or shrink in dry or wet weather, avoiding the necessity of repeated setting up as in Hemp.

2. Wire Rope is 40 per cent. less weight than Hemp, saving so much top hamper.

3. Wire Rope is very much smaller for equal strength, and having but four-tenths the surface of Hemp Rope exposed to the wind, enables the ship to run closer to the wind.

4. Wire Rope is spliced equally well in all kinds of weather, and much more neatly than Hemp.

5. The jib runs down Wire Rope freer, seldom requiring the down haul.

6. Wire rope presents a neat and trim appearance, looks ship-shape; and one suit of wire-rigging in the absence of accident, will last the ship's life.

7. Lastly, and to ship owners very important! Wire rope COSTS VERY MUCH LESS than Hemp or Chain.

Explanation of the Signs used in this Work.

Addition or plus,	+	Division,	÷	Cube Root,	$\sqrt[3]{}$
Subtraction or minus	—	Equal to,	=	Square,	^{2}
Multiplication,	×	Square Root,	$\surd$	Cube,	^{3}

On the Power of Blocks and Tackles.

RULE FOR ASCERTAINING THE POWER TO BE EXERTED IN RAISING WEIGHTS BY PULLEYS.

When only one Rope or Cord is Used.

RULE.—Divide the weight to be raised by the number of the parts of the rope engaged in supporting the lower or movable block.

Ex. 1. What power is required to raise 1200 lbs. when the lower block contains six sheaves, and the end of the rope is fastened to the upper block?

1200 lbs. ÷ 12 = 100 lbs., the power to be exerted.

Ex. 2. Suppose the end of the rope is fastened to the lower blocks, what power is required?

$1200 \div 13 = 92\frac{4}{13}$ lbs., the power to be exerted.

TO ASCERTAIN WHAT WEIGHT CAN BE RAISED BY CERTAIN POWER EXERTED.

RULE.—Multiply the number of the parts of the rope by the power exerted.

Example.—Suppose six parts of rope to be used and fifty pounds power exerted—the weight that can be raised will be 300 lbs.

Note.—The Weston differential or Doyle Chain Pulley consists of a double and single block, the upper block consisting of two chain sheaves, of different diameters, fixed to each other—the lower block being a single chain sheave. The power gained being in proportion to the difference in the diameters of the two upper sheaves—the smaller the difference the greater the power, and *vice versa.* The chain fall is endless and does not run back by the load being hoisted.

Heavy derricks and cranes have recently been fitted up with wire rope tackle, two, three or four fold, iron blocks with sheaves 12 or 14 inches diameter, with a steel rope $1\frac{1}{4}$ inch circumference for a fall, works very much smoother than chain, and does not rot out like a Manila fall rope.

Tensile Strength of Materials.

Weight or force necessary to tear asunder 1 in. square in lbs.

Metals.

Copper.....lbs.	32,500	Lead, cast.....lbs.	1,800
Copper Wire..... "	61,200	" milled..... "	3,320
Gold, cast..... "	20,000	Platinum Wire..... "	53,000
Iron cast...lbs.,	18,000 to 30,000	Silver, cast..... "	40,000
" medium bar.....lbs.	50,000	Steel soft..... "	120,000
Iron Wire..... "	100,000	" razor ..... "	150,000
" " annealed.. "	60,000	Ref'd Crucible Steel Wire	175,000

Woods.

Ash.....lbs.	16,000	Mahogany.....lbs.	21,000
Beech..... "	11,500	Oak, American white.. "	11,500
Cedar..... "	11,400	Oak, seasoned..... "	13,600
Elm..... "	13,400	Pine, "pitch,"..... "	12,000
Fir, strongest..... "	12,000	Teak, Java..... "	14,000
Lignum Vitæ..... "	11,800	Walnut..... "	7,800

Miscellaneous Articles.

Brick.....lbs.	290	Slate.....lbs.	12,000
Ivory..... "	16.000	Whalebone..... "	7,600

Note.—The practical value of the above is about one-fourth.

TO FIND THE STRENGTH OF DIRECT COHESION.

RULE.—Multiply area of transverse section in inches by weight given in the preceding table—the product is the strength in lbs.

Example.—What is the strength of a bar of medium iron 2 inches square?

Transverse section of 2 inches=4 inches, multiplied by 50,000, equals 200,000 lbs., the answer required.

The absolute strength of materials pulled lengthwise, is in proportion to the square of their diameters.

Expansion of Iron by Heat.

The tensile strength of metals varies with their temperature, generally decreasing with increase of temperature.

100° of heat will expand a bar of cast iron .0006173 or the 1620th of its length.

100° of heat will expand a bar of wrought iron .0006614 or the 1512th part of its length.

Galvanized Iron Wire Rope for Ships' Standing Rigging

Possesses many advantages over Hemp, requiring no stripping or refitting, as Hemp Rope must have every few years; and being once set up, it obviates the attention and trouble caused by the stretching and shrinking of Hemp, and by its extreme lightness, being but two-thirds the weight of Hemp, increases the ship's capacity for cargo. And the advantage derived from the smaller surface opposed to the wind, (Wire Rope being one-half the size of Hemp) especially in beating to windward, needs no comment—while for the jib and flying jib stays, its smallness and smoothness permit the hanks to travel on it much more freely.

EXTRACT FROM THE REPORT OF THE SECRETARY OF THE NAVY, 1867.

"During the year, twenty-three vessels have been wholly, and several others partially wire rigged. Tests of the comparative strength of Wire and Hemp Rope, and reports of commanders of wire rigged vessels, have been so satisfactory, that the Bureau recommend the erection of a building, and the purchase of necessary machinery, for the manufacture of wire rigging" (at Charleston Navy Yard).

EXTRACT FROM SAN FRANCISCO *Times*, AUGUST, 1867, IN REFERENCE TO THE BURNING OF THE SHIP "*Blackwall*," IN THIS HARBOR.

"The forehold, where the fire originated, was burned nearly down to the shell—the forecastle was completely destroyed, the foremast so badly burned that it will have to be taken out, and the houses on deck were also rendered useless. *It was a fortunate thing that the ship's rigging was all wire; had she been rigged with hemp, the shrouds would, of course, have caught fire,* and the masts and yards would in all probability have been burned, and the difficulty of saving her would have been doubled."

Wire Rope possesses so many advantages for the standing rigging of ships that it is rapidly displacing every other kind of rigging.

Tensile Strength of Wire Ropes.

The tensile strength of Iron and Steel Wire Ropes, is about 40,000 lbs. per inch area of Iron Rope, and 80,000 lbs. per inch area of Crucible Steel Rope; or, 1 lb. of Iron Wire Rope, 1 foot long, breaks at from 10 to 12 tons, and 1 lb. of Steel Wire Rope, 1 foot long, breaks at from 18 to 20 tons. One-sixth to one seventh of the breaking strength of Iron and Steel Wire Rope, is considered a safe working load.

Areas of States, Territories, Etc., in Square Miles.

The following table gives the areas of the States and Territories according to the last census:

	Gross areas	Coast waters (bays, gulfs, sounds, etc.)	Rivers and smaller streams	Lakes and ponds	Total water surface	Total land surface
Alabama	52,250	440	260	10	710	51,540
Arizona	113,020	.....	80	20	100	112,920
Arkansas	53,850	.....	540	265	805	53,045
California	158,360	540	240	1,600	2,380	155,980
Colorado	103,925	.....	270	10	280	103,645
Connecticut	4,990	25	80	40	145	4,845
Dakota	149,100	.....	610	790	1,400	147,700
Delaware	2,050	30	60	.....	90	1,960
District of Columbia	70	.....	10	.....	10	60
Florida	58,680	1,800	390	2,250	4,440	54,240
Georgia	59,475	150	300	45	495	58,980
Idaho	84,800	.....	200	310	510	84,200
Illinois	56,650	.....	515	135	650	56,000
Indiana	36,350	.....	330	110	440	35,910
Indian Territory	64,690	.....	600	.....	600	64,090
Iowa	56,025	.....	450	100	550	55,475
Kansas	82,080	.....	380	.....	380	81,700
Kentucky	40,400	.....	375	25	400	40,000
Louisiana	48,720	1,060	540	1,700	3,300	45,420
Maine	33,040	545	300	2,300	3,145	29,895
Maryland	12,210	1,850	500	.....	2,350	9,860
Massachusetts	8,315	125	60	90	275	8,040
Michigan	58,915	.....	260	1,225	1,485	57,430
Minnesota	83,365	.....	360	3,800	4,160	79,205
Mississippi	46.810	30	340	100	470	46,340
Missouri	69,415	.....	630	50	680	68,735
Montana	146,080	.....	410	360	770	145,310
Nebraska	76,855	.....	630	40	670	76,185
Nevada	110,700	.....	35	925	960	109,740
New Hampshire	9,305	.....	80	220	300	9,005
New Jersey	7,815	205	120	35	360	7,455
New Mexico	122,580	.....	115	5	120	122,460
New York	49,170	350	300	900	1,550	47,620
North Carolina	52,250	3,260	250	160	3,670	48,580
Ohio	41,060	.....	140	160	300	40,760
Oregon	96,030	50	500	920	1,470	94,560
Pennsylvania	45,215	.....	200	30	230	44,985
Rhode Island	1,250	135	10	20	165	1,085
South Carolina	30,570	215	180	5	400	30,170
Tennessee	42,050	.....	200	100	300	41,750
Texas	265,780	2,510	800	180	3,490	262,290
Utah	84,970	.....	80	2,700	2,780	82,190
Vermont	9,565	.....	50	380	430	9,135
Virginia	42,450	1,780	520	25	2,325	40,125
Washington	69,180	1,380	560	360	2,300	66,880
West Virginia	24,780	.....	135	.....	135	24,645
Wisconsin	56,040	.....	420	1,170	1,590	54,450
Wyoming	97,890	.....	85	230	315	97,575
Unorganized Territory	5,740	.....	.....	.....	.....	5,740
Delaware Bay	620	620	.....	.....	620	.....
Raritan Bay and lower New York Bay	100	100	.....	.....	100	.....
Totals	3,025,600	17,200	14,700	23,900	55,600	2,970,000

Iron and Steel Wire Rope for Hoisting.

For Deep Shafts, Incline Planes, or Slopes, Wire Rope is particularly well adapted; being so much lighter than other ropes or chain, requires proportionately less power to hoist it, and occupies less than half the space on the drum. Its durability is from three to five times that of Hemp or Manila, and its weight is not increased or its fibres destroyed by working in wet situations.

As a practical illustration of the advantages of Iron Wire Rope over Hempen Rope, we submit the following:

Shaft 500 feet, Load including cage	3,000 lbs.
500 feet, 2 inch diameter, dry Hemp Rope weighs	650 lbs.
500 feet, $\frac{3}{4}$ inch diameter, Iron Wire Rope weighs	420 lbs.
Difference in favor of Wire Rope	230 lbs.

Allowing 1 minute hoisting time, then $\frac{500}{1} \times \frac{230}{2} = 57{,}500$ ft. lbs. $= 1\frac{3}{4}$ horse power saved by using Iron Wire Rope.

The difference in favor of Crucible Steel Wire Rope is still greater, and may be summed up as follows:

1st. Crucible Steel Wire Rope is three times as durable as the best Manila or Hemp Rope.

2d. Crucible Steel Wire Rope weighs only four-tenths the weight of Manila of equal strength, when dry, and one-fourth when Manila or Hemp is wet.

3d. Crucible Steel Wire Rope is only one-third the thickness of Manila of equal strength.

4th. Crucible Steel Wire Rope possesses more springiness or elasticity than any other kind of Rope.

5th. The first cost of Round Steel Wire Rope is 75 per cent. the first cost of Manila Rope.

From the above we invite Superintendents and Engineers of Mining Companies using Rope, especially in deep shafts, to the following analysis of comparative cost, etc.

1st. Round Steel Wire Rope has been employed in California for over twelve years, in vicinities of Grass Valley, Downieville and Columbia, and the durability usually exceeds four times that of Manila.

2d. Take, for instance, a Manila Rope $2\frac{1}{4}$ inches thick, 1,000 feet of this size Rope will weigh about 2,200 lbs., *when dry*. Round Steel Wire Rope, same strength and length, will weigh 900 lbs., *wet or dry*. Difference in favor of Steel Rope, 1,300 lbs. For a 1,000 foot hoist, allowing two minutes, $\frac{1000}{2} \times \frac{1300}{2} = 325{,}000$ ft. lbs. = 10-horse-power; using say $\frac{1}{2}$ cord of wood at $6

per cord=$3 per day or $1,080 per annum, (360 days) expended in *hoisting up a dead weight of Manila Rope over that of Steel Rope.* Add to this the strain, wear and tear of the machinery, and you will ascertain approximately what the present outlay is for hoisting ropes.

3d. The thickness of Round Steel Wire Rope being one-third that of Manila of equal strength, it takes proportionately less room on the winding drum; thus 1,000 feet Steel Rope, $\frac{3}{4}$ in. in diameter, will wind on a drum five feet diameter and four feet long, with a *single* layer, while it will require *three layers* of Manila.

4th. Steel Wire Rope, although possessing more springiness in itself, does not *stretch out* like Manila, but takes back the spring it has given out. This elasticity relieves the dead strain on the rope, especially in case of sudden start of the hoisting engine.

SUMMARY:

Life of Manila Rope, say 4 months, equal 3 ropes for 1 year, each rope costs, say $400	$1,200
Extra cost of fuel for hoisting dead weight, 1 year	1,080
Cost of 1 year running of Manila Rope	$2,280
1 Round Steel Wire Rope equal to above 1 year	400
Annual saving effected by using Steel Wire Rope	$1,880

We submit the above facts for your consideration and verification, modifying it to suit localities.

In applying Round Wire Rope the *groove* of the pulley over which the rope runs should be of the *same form and size* as the rope employed, and all drums and pulley sheaves should be 100 times the size of the rope for coarse ropes, or 60 times for flexible wire ropes.

Note.—Within the past 10 years, Steel made by the Bessemer and Sieman-Martin processes has become quite popular, but it does not possess the value of refined crucible steel, and must not be confounded with it.

Velocity of Earthquakes

From experiment by mallet is:

19 miles per minute in granite.
14 " " " slate.
9½ " " " sand.

Velocity of sea-wave due to submarine earthquake is from 6 to 7½ miles per minute, and height of the wave near to locality of earthquake from 30 to 60 feet.

—LeConte's Elements of Geology.

Strength of Posts and Columns.

SAFE WEIGHT IN POUNDS PER SQUARE INCH FOR CAST IRON.

Length in diameters.	Hollow Cylinder.	Solid Cylinder.	Square + and T Sections.
10	25,759	18,000	19,800
20	12,825	6,800	8,550
30	7,200	3,840	4,800
40	4,833	2,610	3,262

Thus a solid cylinder, 20 feet long, 1 foot diameter, will support safely 6800 lb. per square inch.

FOR TIMBER.

Length in diameters	10	20	30	40	50	60
Pounds per inch of section	900	600	336	229	143	100

A timber post 30 feet long, 1 foot diameter, will safely sustain 336 lbs. per square inch.

—Whipple's Bridge Building.

For obtaining the strength of Columns, Prof. Rankine gives the following formula:

$$P=\frac{f\times s}{1+a\frac{l^2}{h^2}}$$

When P=breaking strength in lbs., s sectional area, l length, h least external diameter, all in inches, f and a constants having the following values for different materials.

	f	a
Wrought Iron	36,000	.00033
Cast Iron	80,000	.0025
Timber	7,200	.004

Examples.

Required ultimate strength of hollow cylindrical cast iron column, 20 feet long, 10 inch external diameter, 1 inch thick.

$$P=\frac{(f)\ 80{,}000\times(s)\ 28.28}{1+.0025\ \frac{(l^2)\ 240^2}{(h^2)\ 10^2}}=927.213 \text{ lbs.}$$

Required ultimate strength of rectangular timber post, 24 feet long, 10 inch x 10 inch.

$$P=\frac{(f)\ 7200\times(s)\ 100}{1+.004\ \frac{(l^2)\ 288^2}{(h^2)\ 10^2}}=166{,}753 \text{ lbs.}$$

Required ultimate strength of solid wrought iron column, 18 feet long, 6 inches diameter.

$$P = \frac{36{,}000 \times 28.27}{1 + .00033 \frac{216^2}{6^2}} = 712{,}848 \text{ lbs.}$$

The foregoing formula apply to columns with ends perfectly true, and carefully bedded and fixed. If ends are rough from the foundry, multiply value of 'a' by 4.

—Vose's Manual for Railroad Engineers.

Crushing Strength

Of various materials, in lbs. per 1 in. square.

Metals.

Cast Iron, American.....	129,000	Copper, cast.....	117,000
Cast Iron, English.....	122,400	Steel, cast.....	295,000
Wrought Iron, American.	83,500	Tin, cast.....	15,500
Wrought Iron, English..	57,100	Lead, cast.....	7,730

Woods.

Ash.....	6,663	Pine, pitch.....	8,947
Birch.....	7,960	Pine, white.....	5,775
Box.....	10,513	Spruce, white.....	5,350
Hickory, white.....	8,925	Teak.....	12,100
Oak, white.....	6,100	Walnut.....	6,645

Stones, etc.

Brick, hard.....2,000 to	4,000	Marble.....9,000 to	23,000
Brick, common..... 800 to	4,000	Mortar..... 120 to	240
Freestone, Conn....	3,319	Portland Cement 1, sand 1	1,280
Granite, Quincy.....	15,300	Sandstone.....2,800 to	10,000

—Haswell.

Tiller Ropes.

As a Tiller Rope for river steamers, it is superior to chain, being lighter, cheaper, and more easily managed, the objection caused by the links of the slack chain catching in the rollers—thus endangering the safety of the boat—is entirely removed.

Morever, in case of fire on board, it is free from danger, while a Hemp or Raw Hide Rope, running as it does from one end of the boat to the other, is the first thing to become destroyed. With a Wire Rope, the pilot can stick to the helm as long as the fire will permit him.

Wire Cables for Suspension Flumes or Water Conduits,

For conveying water across deep gulleys, canyons, rivers, etc., with galvanized iron piping, joints, suspension rods, etc., etc., complete.,—the most economical way of carrying water over a deep canyon, etc. Guaranteed to keep in perfect order. Estimates given and materials furnished low.

Wire Rope for Suspending Hydraulic Hose or Pipe clear of a Cave.

The high banks down which a hydraulic hose descends are very apt to cave and destroy the hose. In order to insure its safety, a Wire Rope is stretched from the top of the bank to the bottom of the claim, at a sufficient angle to escape the bank in case of a cave. To this Wire Rope the hose is attached, and in such a position as to be perfectly secure from any danger of destruction by the caving of the bank.

The loss of one hydraulic hose would buy many Wire Ropes.

Iron and Steel Ferry Rope

Stretched across the river, being lighter, is more easily set up, and being perfectly round and smaller it allows the pulley blocks to run much freer and more rapidly over the rope and removes the sudden strain caused by checking (as with a Hemp Rope), when the boat is in the centre of the stream, and does not require the constant attention of the ferryman to set up or slack off the rope, according to the state of the weather; and as the sun does not rot it, it can be kept stretched during the Summer. Iron sheaves should not be used on Wire Ferry Rope, *unless the groove of sheave* properly fits the rope.

For a Swinging Ferry, where the rope lays in the water, it does not rot—nor does it, like Hemp, absorb the water until it becomes water-logged and clumsy. Hemp Rope, thus saturated, will have *four times* the weight of Wire Rope placed in the same position; thus in slack water, with Wire Rope, there is no useless expenditure of the force of the current in carrying the rope across; and consequently, smaller and lighter buoys are required.

N. B.—We have had Wire Ropes working as above for seven years.

Ferry Blocks furnished complete.

The Transverse Strength of Materials.

The transverse strength of any beam or bar of wood or metal is as the square of the depth multiplied by the breadth and divided by the length between the supports.

The transverse strength of any square beams of equal length, is as the cube of their depth—and that of cylindrical beams as the cube of their diameter.

The strength of a projecting beam is only one-fourth of what it would be if supported at both ends, and the weight applied in the middle.

The strength of a projecting beam is only one-sixth of what it would be if *fixed* at both ends, and the weight applied to the middle.

The strength of a beam to support a weight in the centre of it when the ends rests merely upon two supports, compared to one the ends being fixed, is as 2 to 3.

Ultimate strength of different materials, one inch square and one foot long, weight suspended from one end.

	Breaking weight.	Value for general use.
Cast Iron	681	225
Wrought Iron, American	650	180
Wrought Iron, English	500	140
Wrought Iron, Swedish	665	182
Steel (extreme)	1918	400
Steel Puddled	800	190
Woods.		
Ash	168	55
Beech	130	32
Elm	125	30
Hickory	250	55
Oak, American white	230	50
Oak, American live	245	55
Oak, Canadian	146	36
Pine, Pitch	136	45
Pine, American	160	50
Teak	206	60
Stones.		
Freestone, Conn	13	4
Freestone, N. Y.	24	8
Granite, Quincy	26	8½

Transverse strength of Cast Iron Bars of various figures, sections of each: 1 inch area, length 1 foot, fixed at one end, weight suspended at other.

Form of Section.	Breaking Weight.
Square	673 lbs.
Square diagonal vertical	568 "
Solid Cylinder	573 "
Hollow cylinder. outer diameter... twice the inner	794 "
Rectangle $2x\frac{1}{2}$	1456 "
Rectangle $3x\frac{1}{3}$	2392 "
Rectangle $4x\frac{1}{4}$	2652 "
Equilateral Triangle edge up	560 lbs.
Equilateral Triangle edge down	950 "
2 in. deep x 2 in. wide x .268 inch thickness	2068 "
2 in. deep x 2 in. wide x .268 inch thickness	555 "

—*Haswell.*

RULE TO FIND THE TRANSVERSE STRENGTH WHEN A RECTANGULAR BAR OR BEAM IS FIXED AT ONE END AND LOADED ON THE OTHER.

Multiply the *value* in the preceding table by the breadth and square of the depth in inches, and divide the product by the length in feet. The quotient is the weight in lbs.

N. B.—When the beam is uniformly loaded throughout its length, double the result.

Example.—What weight will a 2 in. square wrought iron bar bear, projecting 2 ft. 6 in. in length?

Value for wrought iron $180 \times 2 \times 2^2 = 1440 \div 2\frac{1}{2} = 576$ lbs.

WHEN THE BEAM IS FIXED AT BOTH ENDS AND LOADED IN THE MIDDLE.

RULE.—Multiply the *value* in the preceding table by six times the breadth, and the square of the depth in inches, and divide by length in feet. The result must be doubled when its weight is evenly distributed along its length.

Example.—What weight will a bar of cast iron 2 in. square and 5 feet in length support in the middle, when *fixed* at the ends?

Value for cast iron $225 \times 2 \times 6 \times 2^2 \div 5 = 2{,}160$ lbs.

WHEN THE BAR OR BEAM IS SUPPORTED AT BOTH ENDS AND LOADED IN THE MIDDLE.

RULE.—Multiply the *value* in the preceding table by the square of the depth, and four times the breadth in inches, and divide the result by the length in feet.

Note.—When the weight is uniformly distributed, double the result.

Example.—What is the weight a cast iron bar 5 feet between the supports, and 2 inches square will support?

Value for cast iron $225 \times 2^2 \times 4 \times 4 = 7,200 \div 5 = 1,440$ lbs.

Example.—How much will an ash beam support, being 10 feet between supports, 8 inches deep by 4 inches wide.

Value for ash, $55 \times 8^2 \times 4 \times 4 = 56,320 \div 10 = 5,632$ lbs.

TO FIND THE DIMENSIONS OF A BAR OR BEAM TO SUPPORT A GIVEN WEIGHT IN THE MIDDLE, BETWEEN FIXED ENDS.

Multiply the length between the fixed ends in feet by the weight, and divide the product by 6 times the *value* of the material; the result will give the product of the breadth and square of the depth.

Example.—What are the necessary dimensions of a beam of American pine, 20 feet long, to support a load of 15,360 lbs.

lbs. ft. Assumed breadth.

$$15,360 \times 20 \div 6 \times 50 = 1024 \div 4 = 256.$$

$\sqrt{256} = 16$; size should be 4×16

Note.—In above example the result is 1,024, which divided by the assumed breadth, 4 in., will leave 256, being the square of the depth 16, or by dividing the result 1,024, by the square of the depth $(16^2) = 256$, gives the breadth 4 in.

Steel Wire Rope for Derrick Fall Ropes

Works to great advantage, especially if the hoisting is done by water or steam-power. The sheaves are made of cast iron 10 to 14 inches diameter, the groove of which conforms to the size of the rope—for ordinary work, a Steel Rope ½ inch thick is sufficient for the purpose. A Fall of this kind properly put on, will outlast five or six Manila Falls, and occupy one-sixth the space on the drum.

Wire Rope for "Derrick Guys."

The universal adoption of the derrick for working deep claims in the river bars, etc., in preference to any other method, being much cheaper, and more expeditious, has drawn attention to its erection, and to the necessity of keeping the derrick *mast* in its proper position. With Manila Guy Ropes this is impossible. The constant stretching and shrinking of Hempen Ropes require the almost constant slacking and tightening of the guys, according to the state of the atmosphere; and when the mast leans out of its position, it is almost impossible to swing the boom to its proper point—with the use of wire rope this is entirely prevented.

Wire Rope as a Suspended Carriage Way.

FOR DELIVERING ROCK, LUMBER, ETC., OVER OTHERWISE INACCESSIBLE POINTS.

There are many points in the mountains where it is impracticable to build a roadway, railway track, or chute. In such a place, a practical and economical method for delivering material is to extend a Wire Rope from the upper to the lower points when it is not too long for a single span, stretching it sufficiently tight to clear all points and obstructions, and on this Wire Rope to run a pulley, below which hangs a basket or box containing the rock—or if it is lumber, a pulley at each end of the lumber is necessary. In many cases in sending down rock, etc., it is found better to use three pulleys, two above and one below the rope, one of the upper pulleys being in advance and the other behind the lower one. By this means the pulleys are kept in the same direction as the rope.

The pulley should be of a large diameter, the groove to be of the same size as the rope.

The Endless Wire Ropeway system is adapted for delivering material across and over mountainous and difficult roads. (See page 25.)

Specific Gravities—Weight of Substances.

Water is well adapted for the standard of gravity. A cubic foot of rain water weighs 1,000 ounces, avoirdupois, and its weight is taken as the unit.

When a body is immersed in water, it loses such a portion of its own weight as is equal to that of the fluid it displaces.

Following is a list of specific gravities of various substances:

Metals.

Brass Plate	8380	Mercury, 60°	13580
Brass Wrie	8214	Nickel	8008
Copper Plates	8698	Platinum, native	16000
Copper Wire	8880	Platinum, hammered	20337
Gold, pure cast	19258	Silver, pure cast	10474
Gold, 22 karat fine	17486	Silver, pure, hammered	10511
Iron, Cast	7207	Steel Plates	7806
Iron, Wrought Bar	7788	Steel Wire	7847
Iron Wire	7774	Tin, pure	7291
Lead, Cast	11352	Zinc, cast	6861
		Zinc, rolled	7191

Dry Woods.

Ash	722	Maple	750
Birch	567	Maple, Birdseye	576
Cedar	561	Oak, Canadian	872
Cherry	715	Oak, English	932
Ebony, American	1331	Oak, Heart, 60 years	1170
Elder	695	Oak, Live	1068
Elm	600	Oak, White	860
Fir	512	Pine, Pitch	660
Hickory, pig nut	792	Pine, White	554
Hickory, shell bark	690	Spruce	500
Lignum Vitæ	1333	Sycamore	623
Locust	728	Teak	700
Mahogany, Honduras	560	Walnut	671
Mahogany, Spanish	852	Walnut, Black	500
		Willow	530

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Specific Gravities—(*Continued.*)

Stones, Earth, Etc.

Asphaltum	905 to 1650
Borax	1714
Brick	1367 to 1900
Brick, Fire	2201
" Work, in cement	1800
" " in mortar	1600 to 2000
Cement, Portland	1300
Clay	1930
Clay, with Gravel	2480
Coal, Newcastle	1270
Coal, Scotch	1259 to 1300
Coal, Anthracite	1436 to 1640
Earth, common soil	2194
Granite, Quincy	2652
Limestone	3180
Marble, Italian white	2708
Quartz	2660
Salt, Common	1670
Slate	2672 to 2900
Sulphur, Native	2033
Trap	2720

Liquids.

Oil, Linseed	940
Oil, Olive	915
Oil, Petroleum	878
Water, rain	1000

Divide the specific gravity of any of the above substances by 16, and the result will be the weight of 1 cubic foot in pounds.

Wire Cord.

For Hanging Sashes, Pictures, Dumb Waiters, Clock Weights, and for Signal Cord.

This Cord is made from iron, steel, copper, galvanized or composition wire, is very light, durable and pliable, and is not subject to rot. It has been in use for many years for the purpose of hanging window sashes, being much preferred to any other cord. No house should be without it. It is the only safe cord to use for hanging pictures or mirrors, as moths cannot attack it. (See List of Prices, on page 92.)

Lightning Conductors.

Copper Wire Rope Lightning Conductors are much in use among the shipping, as a protection against the effects of lightning on a ship's mast. They are superior to any other conductor as a protection against lightning for church spires, tall chimneys, etc, are much more easily fixed, and do not get out of order. (See List of Prices, on page 92.)

TRANSPORTATION OF ORE AND OTHER MATERIAL

BY MEANS OF ENDLESS TRAVELLING WIRE ROPES.

Hallidie's Patent Ropeway.

The system of transporting material by means of an endless travelling wire rope has been well and thoroughly tested during the past six years under a variety of circumstances, which has proved its economy, simplicity, and advantages.

The "Endless Ropeway," introduced in the year 1871, and protected by numerous U. S. patents granted to Mr. A. S. Hallidie, has been in operation for six years, and proved itself in every way the most reliable, economical, and simple mode of conveying ores, rock, earth, lumber, produce, and material of all description, that can be conveyed in reasonable size packages over difficult roads, or over roads inaccessible to the most economical and rapid modes of steam locomotion.

During the past six years, many very valuable improvements have been made in the details of construction, reducing the cost of the same and simplifying its operations.

The principles of its operations will bear the strictest criticism, and an examination of the same by skilled or scientific mechanics, will demonstrate the great advantages over the many methods now in operation for similar purposes.

Its mode of operation may be briefly summed up as follows:—

And endless wire rope is supported at intervals of from 150 to 200 feet, on grooved wheels or sheaves, which are secured to the ends of cross-arms, elevated on suitable posts or towers, about 16 feet above surface obstruction of the ground; the bights of the endless rope are placed around end sheaves or grip pulleys, placed horizontally, one at each extremity of the line. The endless rope thus passes around horizontal end sheaves or grip pulleys, and is supported between these end sheaves at proper intervals, on bearing sheaves of such proportions that the friction is reduced to a minimum.

The office of the end, or "grip" pulley, is to transmit power to or from

the endless rope, so that the rope cannot slip in the groove of the pulley, and the speed of the rope can be regulated by them.

The conveyers or carriers used for moving the material, the form of which is regulated by the character of the material to be moved, are attached to the rope by means of steel clips of peculiar form, at distances regulated by the amount of the material to be moved.

It will be seen that when the rope is set in motion, either by gravitation or by other motive power, it will carry with it the carriers or conveyers at such rate of speed as may be determined to be most suitable.

These are so arranged that they pass over the bearing sheaves and around the end or grip pulleys. At any point in the line of the Ropeway the carrier can be loaded or discharged. The rope runs at an uniform rate of speed, about 200 feet per minute; and the carriers are loaded as they pass, and at the point of discharge are unloaded automatically.

When the point of discharge is lower than the point of loading, the Ropeway will run by gravitation, if the angle of descent exceeds 8 degrees, or 1 in 7. When it is less than 8 degrees power has to be employed, and this can be attached anywhere on the line—either steam, water or other motor. Where the line runs by gravitation, brakes are attached to the end grip pulleys, and the speed thus regulated, and at the same time the line is under control of the man in charge.

For conveying ore from the mine to the mill, the carriers are wrought iron rectangular buckets, holding 100 lbs. ore, and are self-dumping.

If the rope travels at 200 ft. per minute and the ore buckets are 100 ft. apart and hold 100 lbs. each, there will be delivered 200 lbs. of ore every minute, or 6 tons per hour, or 60 tons per day of 10 hours—this is about as much as two men can conveniently shovel into a cart, and for an ordinary line run by the gravitation of its descending load, this is all the attendance necessary. One of the men should go over the line once a day and see that the journals are properly oiled.

For a line one mile long, running by gravitation and delivering 60 tons per day, the cost of delivering ore is under 15 cents per ton, as follows:

Two men at $50 per month	$100 00
1¼ per cent. wear and tear	75 00
10-12 per cent. interest on cost	50 00
Oil, &c	5 00
Cost per month	$230 00

Sixty tons per day for 26 days per month = 14¾c. per ton.

By placing the buckets 50 feet apart, the amount of ore carried will be doubled, or 120 tons per day of 10 hours—or by running 20 hours per day the same result will be obtained—in both cases the number of men required for loading will be doubled, but the cost of carrying the ore will be reduced to about 10c. per ton per mile.

When the angle of descent is very great, the descending load furnishes sufficient power to carry back and up to the Mine such material as may be needed—and in several lines we have constructed, this saving, when taken into account, has been so great that it has not only brought the cost of transporting the ore to nothing, but has been actually a source of revenue.

Again, in cases where a limited power is needed at the mine for pumping, etc., the power can be supplied from the mill by means of the grip pulleys and the endless wire rope.

In brief, the foregoing system is *applicable* for the following purposes:

For conveying ores from the mine to the mill.

For conveying light loads of any material from place to place.

For transporting produce and lumber across difficult points, and to shipping in an offing.

For conveying passengers across gorges, chasms and over hazardous roads.

For supplying water to reservoirs across chasms, etc.

The *advantages* claimed are:

No grading or road-building is required.

It can work under all circumstances of weather, with great depths of snow on the ground, during heavy storms and freshets.

It can run constantly without rest; as well during a dark night as a clear day.

It can cross deep gorges and chasms.

It can pass around precipitous bluffs and perpendicular cliffs, or over the most rugged mountains.

The rope can never leave the posts or sheaves.

It can furnish and transmit power, when there is sufficient descent, by its own gravitation, or by an engine attached to either end.

It can be constructed and worked cheaper than any other system or road can be constructed and worked under like circumstances.

By using the duplex carrier it can convey any material, such as lumber, goods, ores, and passengers, from place to place.

The letters and extracts herewith appended speak for themselves:

EUREKA, Nevada, July 10th, 1872.

T. M. MARTIN—*My Dear Sir:* On your leaving for San Francisco, it gives me great pleasure to hand you my written acceptance of the HALLIDIE TRAMWAY, put up by you upon our mine in Freiburg.

It is a perfect success, discharging ten tons of ore per hour with two men's labor. It is perfectly simple in construction, and, as far as I can judge, there is nothing about it to ever get out of order—nothing to wear out. While ours requires but about 2,500 feet of Wire Rope, I can see no reason why the line could not be extended almost indefinitely with equally happy results. Again, the carrying capacity might be doubled or quadrupled if desired. After several weeks trial upon our mine, the unanimous verdict of all who have seen it, is a complete, unquestioned success. If this can be of any service to you, use it in any way you think proper. Very respectfully,

C. C. GOODWIN.

EMMA HILL CONSOLIDATED MINING CO.,
LITTLE COTTONWOOD, Utah.
Superintendent's Office, Sept. 28th, 1872.

T. M. MARTIN, ESQ.—*Sir:* The Ropeway constructed by you (HALLIDIE'S PATENT), for the Emma Hill Consolidated Mining Company, has been built in a most substantial and workmanlike manner, and is at this time in splendid working condition. I most cheerfully accept the work for the Company, and recommend it to others wishing a sure and speedy transit for ores over places impracticable for wagon roads, etc.

Respectfully,
L. U. COLBATH,
Superintendent.

[From the *Utah Mining Journal*, Salt Lake, Sept. 23, 1872.]

THE VALLEJO ROPEWAY.

The Vallejo Tunnel Company's Tramway in Little Cottonwood, built on the HALLIDIE PATENTED PLAN, is a complete success. It is between 2,300 and 2,400 feet in length, and is supported by thirteen stations. The fall in this distance is about 600 feet, and the Wire Rope, which is five-eighths of an inch in diameter, will safely and easily deliver 100 tons in six hours. The machinery is automatic, loading and unloading the sacks or buckets. The stations are about 200 feet apart, and the entire apparatus is strong and safe. As the Wire Rope is elevated about 40 feet above the surface of the hill, the Tramway can be worked all winter long, without the slightest trouble.

OFFICE OF THE CHICAGO SILVER MINING CO.,
SALT LAKE CITY, DEC. 1, 1874.

A. S. HALLIDIE, ESQ.—*Dear Sir:* I have pleasure in stating that your Ropeway, put up at the Chicago Mine, Ophir District, Utah Territory, one year ago last summer, has been in constant use ever since, and with the most satisfactory results.

The line, as you are aware, is constructed over an extremely rugged country, one and one-quarter miles in length.

For the first half mile or so, it is down a very steep mountain side, whence it passes over the brow of another one; thence it continues down Dry Cañon at an angle of 15 to 18 degrees.

The structure is an entire success, the cost entire of which has more than been saved already, although it has not been worked up to half its capacity.

In the estimate of earnings no account was taken of supplies sent to the mine, including water, etc., by no means an inconsiderable item.

Truly Yours,

W. S. GODBE.
Manager Chicago S. M. Co. (Limited.)

SUPERINTENDENT'S OFFICE,
EMMA HILL CONSOLIDATED M. CO.,
LITTLE COTTONWOOD, UTAH, DEC. 17, 1874.

A. S. HALLIDIE, ESQ.—*Dear Sir:* In answer to your inquiry, I have to report that the Ropeway (built August, 1872,) continues to work splendidly, and with but little wear on the rope. It has been everything that was promised, and has proved to be the cheapest way to move ores on steep mountain sides. Yours very truly,

L. U. COLBATH,
Superintendent.

KERNVILLE, Kern County,
California, May 6th, 1878.

A. S. HALLIDIE, ESQ.—*Dear Sir:* Your Patent Wire Ropeway, which I recently erected at the Harley Mine, near this place, works entirely satisfactorily, effecting a great saving in the cost of transporting ore from the mine to the mill, and in sending lumber and supplies to the mine. The cost of transporting the ore by pack train was five dollars per ton---by your ropeway, it does not exceed fifty cents. The length is one mile and a half, the upper end having an elevation of over 3,000 feet above the lower end. It crosses a high cañon at a height of over 300 feet from the surface of the ground with a single span of 750 feet; and, altogether, the ground is among the roughest in the Sierra Nevadas.

Respectfully yours,

A. BLATCHLY, M. E.

CHEMICAL LABORATORY AND GENERAL MINING OFFICES,
504 Washington St., San Francisco, May 15th, 1878.

A. S. HALLIDIE, ESQ.—*Dear Sir:* In answer to your inquiry about the "Wire Ropeway," erected by my advice, for the Blue Jacket Mining Company, Bull Run District Elko County, Nevada, I have pleasure in stating that, under the following conditions, it works surpassingly well, and transports the ore by its own weight without other power, for nearly a mile, over a rough, descending grade of 11 degrees from the mine to the mill, at a cost of about 20 cents per ton; thereby saving at least $2 per ton, compared with horses.

Yours respectfully,

J. S. PHILLIPS.

OFFICE OF STANDARD GOLD MINING CO.
SAN FRANCISCO, Oct. 8, 1878.

A. S. HALLIDIE, ESQ.—*Dear Sir:* The Ropeway you erected for us in December, 1877, has now been in use over nine months and has given very great satisfaction, enabling us to transport our ore from the mine to the mill, a distance of half a mile, without interruption, and during all kinds of weather. We send over the line forty-seven tons per day of seven hours, and the saving, over the old method of hauling, is fully seventy-five per cent. In addition to the important fact of being able to get our ore regularly, regardless of the weather, we can send back water, lumber, etc., without cost.

The expense of running the line, bringing down the ore, repairs,&c., is about ten dollars per day.

We are well satisfied with the manner in which it works.

JOHN H. BOYD,
Vice-President.

WM. WILLIS,
Secretary.

FIG. 1. GENERAL VIEW OF ROPEWAY.

GENERAL SUGGESTIONS

FOR ERECTING

HALLIDIE'S ROPEWAY.

In determining the route it is better to avoid vertical angles, *i. e.* as a rule to go over a hill (if it be not too great) rather than around it, and make the line as direct as possible, and in a true line, avoiding unnecessary angles. The general appearance of the Ropeway is shown in the large engraving, Fig. 1.

Upper Terminus.

In locating the upper terminus (at the mine) it is important to be as near the tunnel's mouth as possible. The horizontal grip pulley should be far enough below the level of the tunnel to enable sufficient ore to be dumped into the bin to keep the line running for a few days.

A hopper-shaped ore bin is constructed, into whch the ore is dumped from the mine; at the lower end it is supplied with a gate that permits about 100 lbs. of ore to pass out at a time, (or enough to fill one of the ore boxes of the Ropeway, the ore is allowed to run out of the mouth of the hopper) into a scoop that is attached to a swinging arm, that swings around the shaft of the grip pulley, and while the travelling ore boxes on the rope are passing, the scoop travels with it and dumps its load into the ore box; or the ore can be simply shoveled into the travelling ore boxes as they pass by.

The grip pulley should therefore be placed—say 20 feet below bottom of tunnel. The frame that carries the grip pulley is constructed as shown in the diagram annexed, Fig. 2. The grip pulley shaft must be vertical, and guide pulleys lead the rope fair into the grips of the pulleys—(these guide pulleys are placed as near to the grip pulley as possible); the frame must be well anchored to a good foundation.

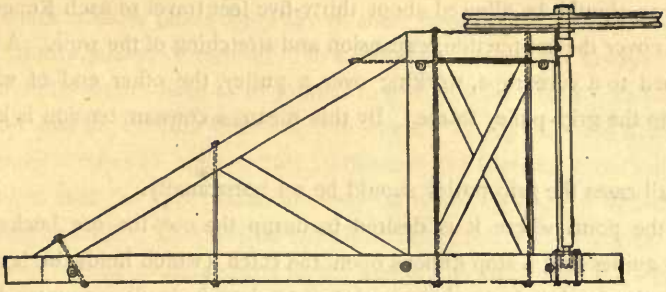


FIG. 2.
Side Elevation of Upper Grip Pulley Frame.

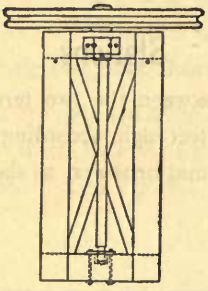
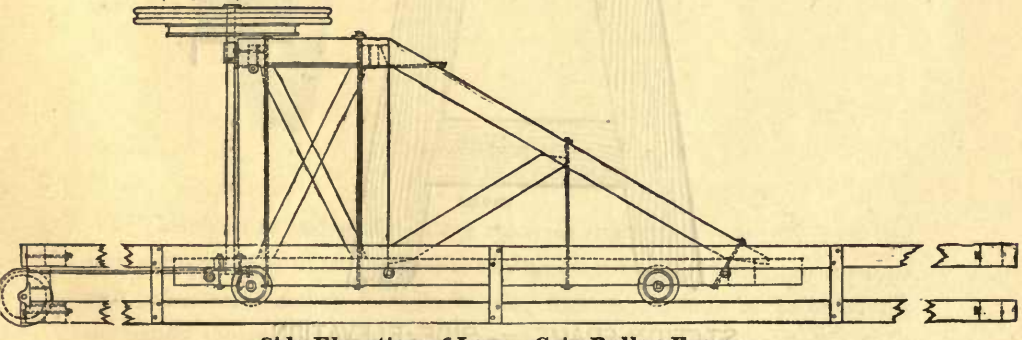


FIG. 3.
End Elevation of Upper Grip Pulley Frame.

Lower Terminus.

The lower terminus should be located at, or beyond the point where the ore is required to be dumped, and the grip pulley frame should be at sufficient elevation to prevent the ore backing up over the track. If the ore is to be transhipped, then an elevated hopper-shaped bin, with escape gates at the lower end will be most convenient—or, the ore can be dumped at any suitable point on the line of the Ropeway.

The grip pulley frame is constructed in the same manner as for the upper terminus, but the frame is placed on heavy car wheels that run on a suitable track. (Fig. 4.)



Side Elevation of Lower Grip Pulley Frame.
FIG. 4.

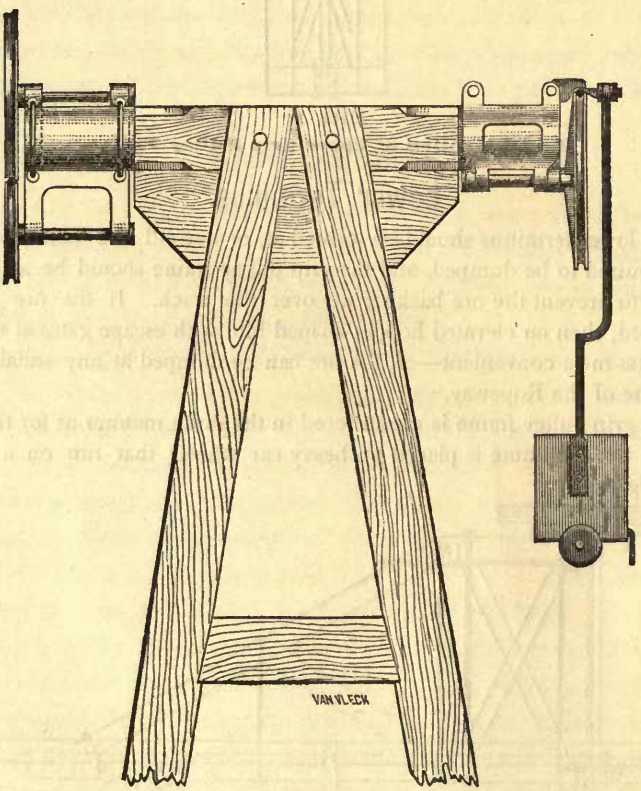
There should be allowed about thirty-five feet travel to each Ropeway, in order to cover the contraction, expansion and stretching of the rope. A weight is attached to a wire rope, working over a pulley, the other end of which is secured to the grip pulley frame. By this means a constant tension is kept on the line.

In all cases the grip pulley should be set horizontally.

At the point where it is desired to dump the ore, the ore buckets pass between guides and a stop knocks open the catch, (which holds the bottom in place) as the bucket is passing, causing it to drop its load; a counter balance attached to the bottom causes it to close again—the guides are either of scantling or bar iron.

Stations.

About 150 feet apart, between the two termini, are constructed frames, called stations, from 14 to 50 feet high, according to circumstances, made from four sticks, which form a pyramid or tower, as shown in Fig. 5.



STATION-FRAME — SIDE-ELEVATION.

Fig. 5.

It is desirable to place the center of these towers in a true line, from shaft to shaft of grip pulleys of termini. In a long line this cannot always be done, and sometimes angles have to be formed to pass around bluffs. In such cases the center line should pass from angle to angle. Or, again—it is necessary to pass around a curve of large radius; in this case the sheaves of the stations are so arranged that the rope leads fair into them and is slightly deflected after leaving the sheaves. This will be explained under the head of angles. At the top of these frames, at right angle to the line of the Ropeway; there is a cross arm usually of 8x8 timber; the length of the arm being about equal to the diameter of the grip pulley. The cross arm is well secured to the frame so as not to twist out of position. At the extremities of the cross arm are fitted cast iron frames that carry the bearing and guide sheaves.

The ends of the cross arm are rounded off to eight inches diameter, and the cast iron frames are secured to them by means of bolts in the cast iron frames, which clasp the ends of the arms. (See Fig. 6.)

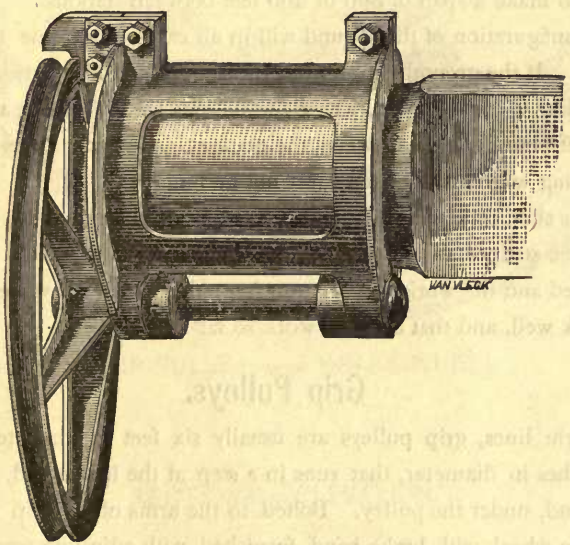


Fig. 6.

The object in having the ends of the cross arm round, is to enable the cast iron station frames to be adjusted to the horizontal angles formed by the rope as it passes on to and off from the bearing sheaves. It must be provided that the station sheaves are so arranged that the rope always runs on them, *fairly in line.*

As the rope, when travelling, tends to pull the end of the cross arm in the direction it is running, the importance of having these arms well braced to resist this tendency will be understood.

The station frames in some cases carry two sheaves, an upper and a lower one, the object of the upper one being to prevent the rope jumping out from its place in the groove of the lower sheave. When the rope runs with a constant downward strain on the lower pulley, a guard of cast iron is placed over the sheave to keep the rope in place, and the upper sheave is dispensed with, as shown in Fig. 6, and this latter is the method now generally adopted, except when the rope is apt to have an upward strain.

Some judgment must be exercised in locating the stations, and usually the higher points are selected, for the reason that shorter towers have to be built and the rope is not diverted so much from its natural curve.

Occasionally it is necessary to hold the rope down much below the point it would naturally sag; in such a case the larger sheave has only a quarter groove, and it is placed above; the smaller sheave has a full groove, and is placed below. See Fig. 5, left hand cross arm. But such cases are rare, and it is better to make a span of 300 or 400 feet between stations.

The configuration of the ground will in all cases determine the height of the stations. If the ground is free from projections and obstructions, the height should not be less than 15 feet, where the stations are 150 feet apart, increasing in height with the distance between the stations. Considerations of depth of snow, crossing wagon roads, etc., must not be forgotten.

Stations should be well secured to the ground, to resist gales, etc.

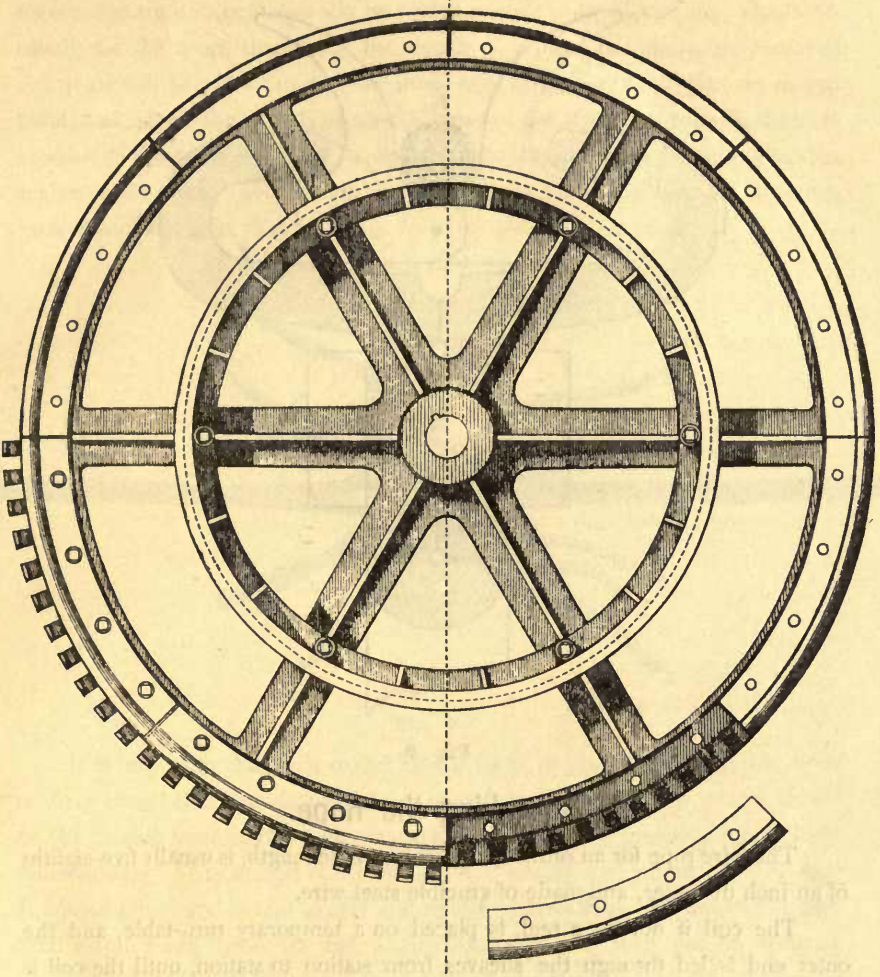
After the stations and grip pulley frames are up, see that all the bearings are well oiled and the working parts run free; that the brake wheels of the grip pulleys work well, and that all your work so far is secure.

Grip Pulleys.

For light lines, grip pulleys are usually six feet in diameter, keyed to a shaft 3½ inches in diameter, that runs in a step at the lower end, and a box at the upper end, under the pulley. Bolted to the arms of the grip pulley, above it, is a brake wheel with brake-band, furnished with adjusting screw and hand wheel. (See Fig. 7.) The brake is used in regulating the speed of the Ropeway, or stopping the same, when it runs by gravitation. Fig. 8 is a section of the rim of the Grip Pulley, showing the grips and mode of working. *h* is the rope which presses on the gripping jaws *i i* which rest on the points *x x* of the rim of the wheel *L L*.

When the line is level and runs by power, this brake is dispensed with.

PLAN



GRIP-PULLEY WITH BRAKE-WHEEL

SECTIONAL ELEVATION

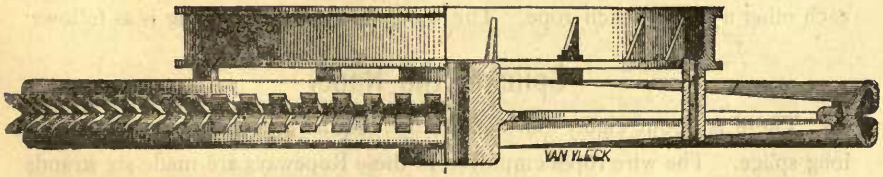


Fig. 7.

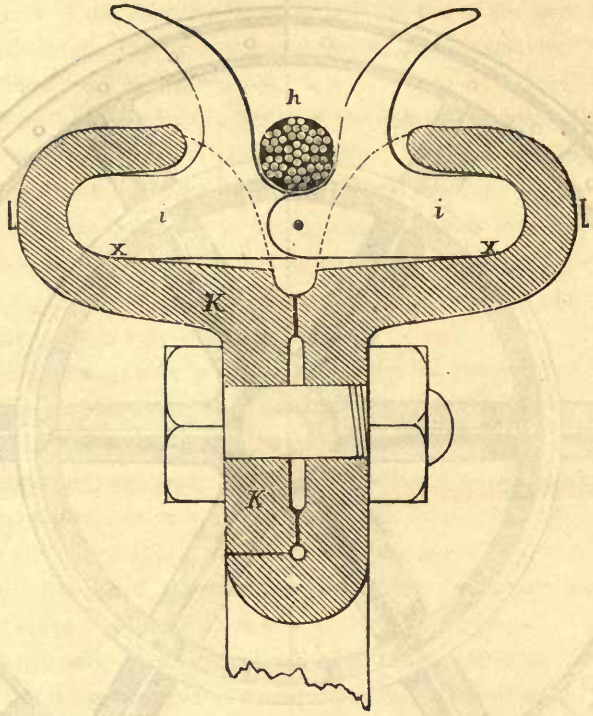


Fig. 8.

Stretching the Rope.

The wire rope for an ordinary line of one mile length, is usually five-eighths of an inch diameter, and made of crucible steel wire.

The coil if not on a reel, is placed on a temporary turn-table, and the outer end is led through the sheaves from station to station, until the coil is exhausted, great care must be taken to prevent any kink getting in the rope—in order to prevent this, it is better to have the rope put on a reel.

If the Ropeway is short, say one-half mile, the rope will probably be in one piece, and may be made of charcoal iron. The two ends are brought together at a place convenient for splicing, and by means of blocks and tackle the rope is hauled up taut, and the point of joining is marked by tying opposite each other a stop on each rope. The mode adopted for splicing is as follows:

Splicing the Rope.

There is about eighty-four feet of rope required to put in a good smooth long splice. The wire ropes employed in these Ropeways are made six strands of seven wires each, and a core or heart; as there are two rope ends to splice

together, there will consequently be twelve strands to be tucked in. Operators usually tie the stops that mark the length of rope, about where the center of the splice will be. In this case the usual way is to unlay each rope up to that point, and place the strands of rope A between the strands of rope B, the core or heart of the ropes A and B, being cut off so that the cores of the ropes abut against each other. (See Fig. 9.) There will be then forty-two feet of strands each side of the stop, thus:

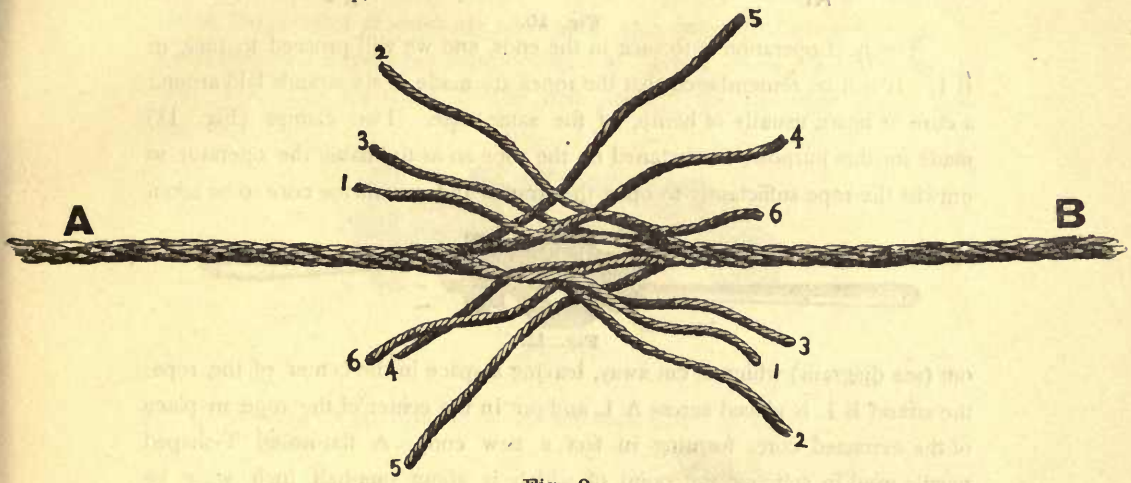


Fig. 9.

It is important that each strand should be in its proper place, so that none of them cross other strands, or that two strands be not where one strand should be (by placing your fingers between each other in natural position, this will be understood). Then strand No. 1 of rope A is unlaid, and strand No 1 of rope B follows close, and is laid snugly and tightly without kink or bend in its place, until within seven feet of the end, a temporary seizing is then put on securing ropes and strands at this point. Strand No. 1 of rope B is then cut off, leaving it seven feet long. Then strand No. 2 of rope A is unlaid, and strand 2 of rope B is laid in its place to within twenty-one feet of its end. Strand No. 3 of rope A is unlaid, and strand No. 3 of rope B laid in its place, within thirty-five feet of end. By this time you have reached within seven feet of the center, and reversing the operation, unlay strand No. 4 of rope B, and lay in its place strand No. 4 of rope A, to within seven feet of its end; unlay No. 5 of rope B, and lay in No. 5 of rope A, to within twenty-one feet of its end; finally, unlay No. 6 of rope B, and lay in its place No. 6 of rope A, to within thirty-five feet of its end. The strands are now all laid in their places and seized down for the time being, the ends are cut off, as with the first strand, to seven feet in length, and present the appearance, as in Fig. 10.

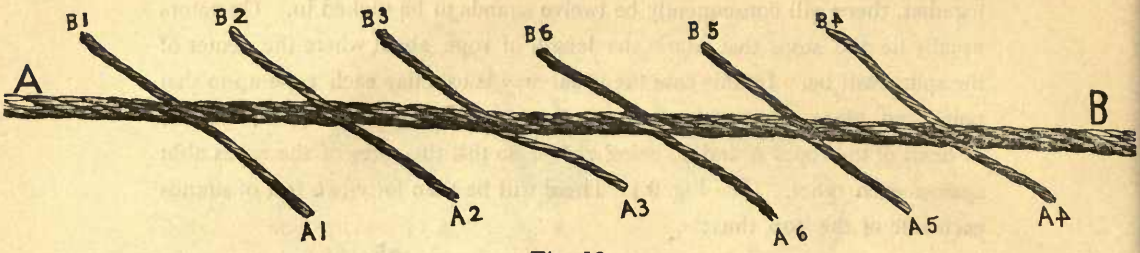


Fig. 10.

The next operation is to tuck in the ends, and we will proceed to tuck in B 1. It will be remembered that the ropes are made of six strands laid around a core or heart, usually of hemp, of the same size. Two clamps (Fig. 11) made for this purpose, are fastened on the rope so as to enable the operator to untwist the rope sufficiently to open the strands and permit the core to be taken

Fig. 11.

out (see diagram) which is cut away, leaving a space in the center of the rope; the strand B 1, is placed across A 1, and put in the center of the rope in place of the extracted core, forming in fact a new core. A flat-nosed T-shaped needle used in splicing, the point of which is about one-half inch wide by three-sixteenths of an inch thick, rounded off to an edge, is well adapted to this purpose. The strand B 1 is laid in its entire length, the core being cut off exactly at the extremity of strand B 1, so that when the rope is closed around the inserted strand, the ends of the strand and core should abut. If there is much space left in the center of the rope without a core, the rope is liable to lose its proper form and some of the strands fall in, exposing the projecting strands to undue wear. The same operation is performed with A 1, running the other way of the rope, and so on, until all the strands are tucked in, which, if properly done, will leave the rope as true and round and as strong as any other part.

Other operators prefer to start from the end of one rope and consequent end of splice. The operation is about the same, but the experience of the writer justifies him in saying that more care has to be used in bringing all the strands to an even tensions in the parts spliced. Other variations in detail are made according to the fancy or practice of the splicer, but after making a few successful splices in manner above described, the operator can afterwards vary to suit himself.

The rope is now spliced into an endless rope, and is in position between the station sheaves, and around the end grip pulleys, so that by turning the grip pulleys at either end the rope should travel freely.

Attaching the Clips.

The next thing is to place the clips and hangers on the rope; the number of clips to be placed on the rope depend upon the amount of ore to be conveyed, and if it is conveyed in ore sacks, a simple hook, or a L-shaped platform is attached to the clip, so that the ore sack may be hooked or laid on. Usually the mode of conveying the ore is by means of rectangular sheet iron boxes, the bottoms of which are on hinges, with counterbalances to close up the bottom and a catch to release or retain it. These boxes hold 100 lbs. of ore. The clips are made of the best steel of the following shape: (see Fig. 12.)

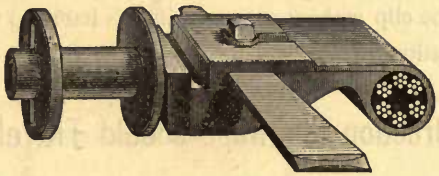


Fig. 12.

The thin part is warmed and opened thus: (see Fig. 13.)

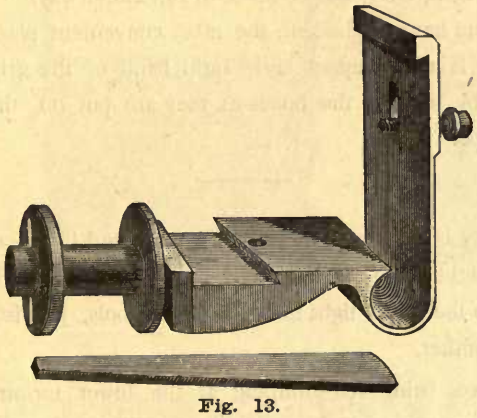


Fig. 13.

so that the rope can be slipped into it, the thin plate being immediately closed over and enveloping the same. The thin plate is drawn over to its place tightly by driving a key into the slot and securing by the set screw. It is thus closely secured to the rope, and capable of sustaining a very heavy load, the peculiar form of the clip enabling it not only to clasp but to rest on the rope.

The outer washer is removed from the turned part of the clip and the eye of the hanger of the ore box is slipped on; the washer is then put back and the pin driven in to secure the same. The ore box is now on, ready for use. It

will be observed that the hanger of the box has a short bend in it; this is to compensate for the projection of the clip. The ore box is made of sheet iron, and the bottom is hinged at one end, the other end being held in place by means of a keeper, which has a projecting arm. As the loaded bucket passes the place where the ore is to be delivered, the projecting arm strikes a stop, which throws the keeper of the catch, releases the bottom of the ore box, and dumps the ore; a counterbalance attached to the bottom closes the ore box, and it is then ready for reloading. Figure 14 is a side view, and Fig. 15 an end view of the ore bucket. The clip will naturally hang at right angles to the line of the hanger, which is plumb or vertical when it is at rest. See Figs. 5 and 15. In same manner the remaining clips and ore boxes are put on. In no case leave the clip without a hanger, as it is liable to turn over and get foul between the station sheaves.

Direction the Rope should Travel.

In the absence of any reason to the contrary, the rule in regard to the direction the rope should travel, is, that the right hand rope recedes from you, as you look towards it, but it can be made to run either way.

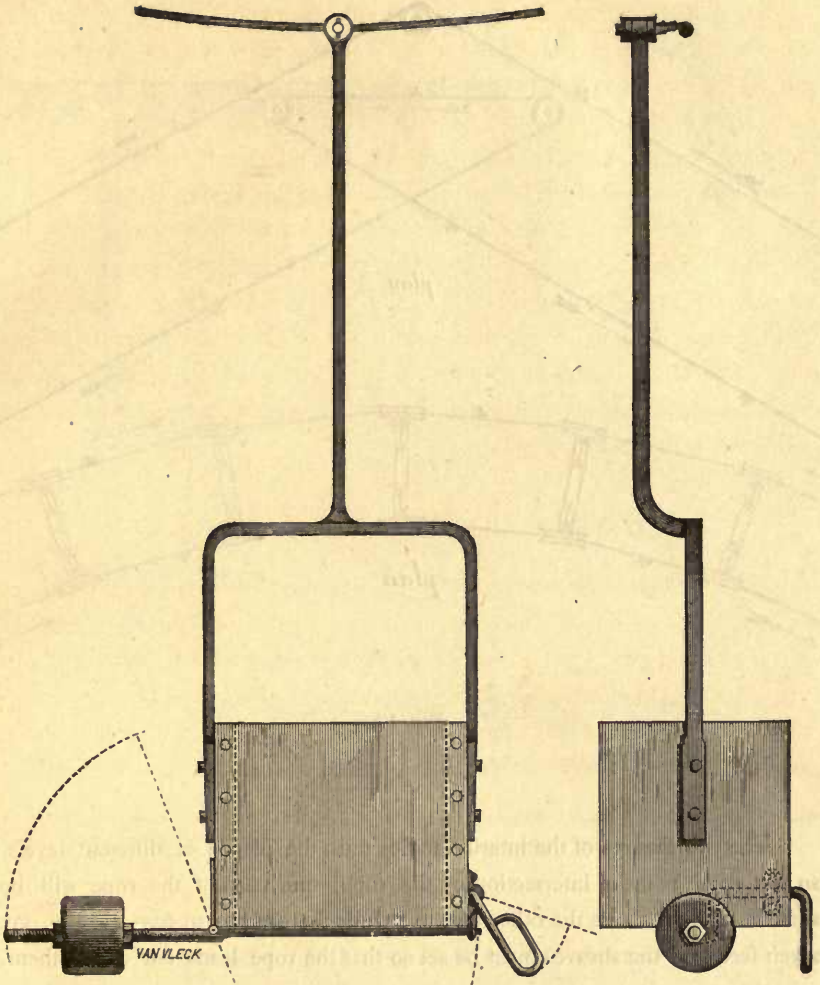
When the line has any descent, the most convenient place to put on the clips and boxes, is at the upper end—right hand of the grip pulley. In a gravitation line, by loading the boxes as they are put on, they facilitate the moving of the rope.

The Ropeway is now ready to put in motion, and if the angle of descent is sufficient, say eight degrees, it will deliver its load to the mill by gravitation, and carry back to the mines light loads, such as tools, provisions and a fair amount of drift timber.

The ore boxes being self-dumping at the lower terminus, require no attendance, and one man can run a line of ordinary length—however, the machinery has to be oiled and kept in order, and a man should pass over the line to oil and examine the station sheaves, the grip pulley gear, etc., every day.

The rope should be kept well tarred (Swedish tar and linseed oil, 4 parts to 1, boiled together, should be used), and all running parts kept from rusting.

No good mechanic need be told that it pays to construct work well, and to take care of it afterwards.



SELF-DUMPING ORE-BUCKET WITH HANGER.

Fig. 14. Fig. 15.

Angles.

In long lines, sharp angles have sometimes to be formed around bluffs, or the line may have to be diverted so as to reach various desirable points, either to discharge or receive ores, or to utilize water power, etc. In these cases the angle is made by using horizontal sheaves of about six feet diameter. A single sheave, placed horizontally, makes the angle of the rope, on which the clips project outward; but to make the angle of the rope where the clips project inwards, two sheaves are required. See upper Fig. 16.

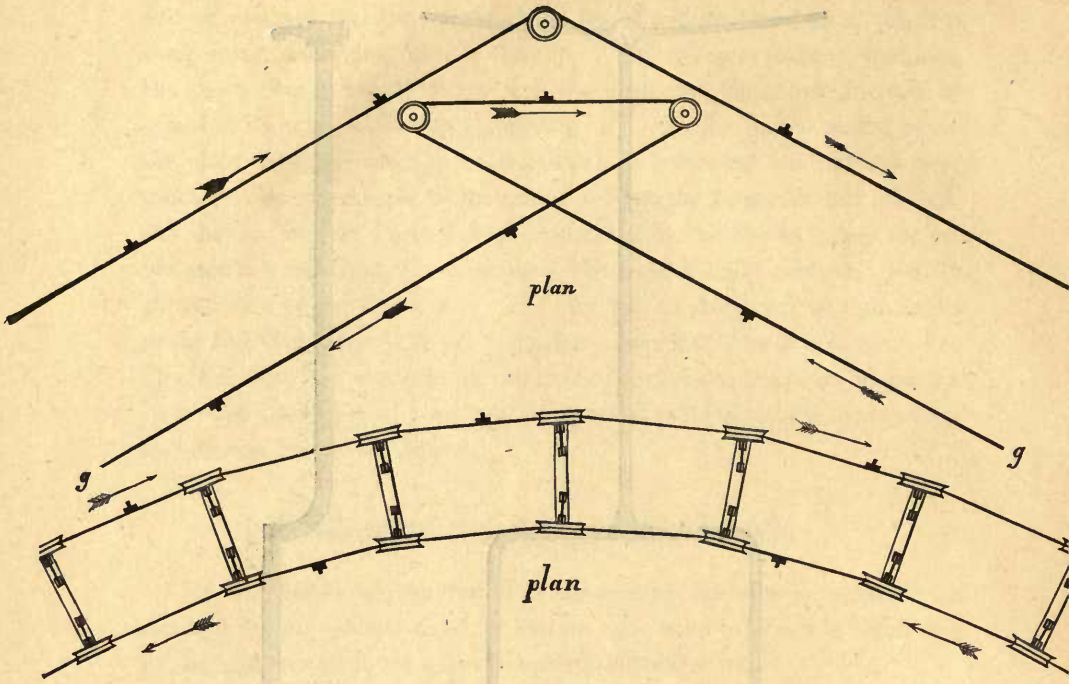


Fig. 16.

The two sheaves of the interior angles must be placed at different levels, so that at the point of intersection of the rope, one part of the rope will be sufficiently high above the other part to permit the ore box to pass over it, say seven feet, and the sheaves must be set so that the rope leads fair on to them.

When the angle is but a few degrees, and of great radius, a series of stations are placed contiguous to each other, the sheaves of which are placed so that the *rope leads on them fairly* and is deflected slightly after leaving the sheaves in the direction of the angle desired. See lower diagram Fig. 16.

To Transport Heavy Loads.

When it is necessary to transport loads heavier than 200 lbs. on a rope five-eighths inch diameter, the number of clips may be increased, and placed from two to four feet apart, as shown in Fig. 17.

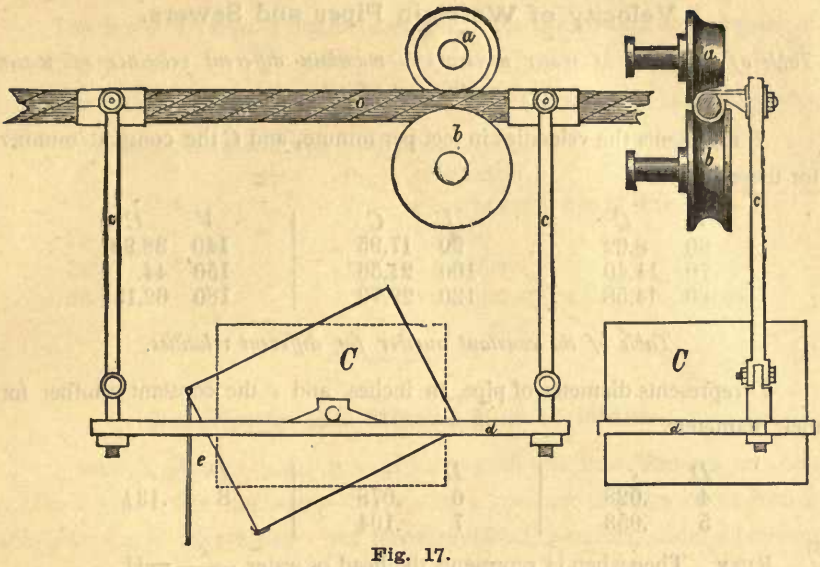


Fig. 17.

Estimates furnished, contracts entered into, or reliable men sent to superintend construction.

For further information, address the

CALIFORNIA WIRE WORKS, LICENSEE,

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Secured under U. S. Patents Nos. 100,140, 110,971, 115,309, 115,310, 121,776, 124,391, 127,690 143,087, 162,915, and applications now pending.

Fall of Angles.

Fall of	1	in	1	equals	angle of	45	degrees.
"	1	"	2	"	"	27	"
"	1	"	3	"	"	19	"
"	1	"	4	"	"	15	"
"	1	"	5	"	"	11	"
"	1	"	6	"	"	10	"
"	1	"	6½	"	"	9	"
"	1	"	7	"	"	8	"
"	1	"	8	"	"	7	"
"	1	"	10	"	"	6	"
"	1	"	11	"	"	5	"
"	1	"	15	"	"	4	"
"	1	"	19	"	"	3	"
"	1	"	28	"	"	2	"
"	1	"	57	"	"	1	"

Velocity of Water in Pipes and Sewers.

Table of the heads of water necessary to maintain different velocities of water in 100 *feet of pipe.*

V represents the velocities in feet per minute, and *C* the constant number for those velocities.

V	*C*	*V*	*C*	*V*	*C*
60	8.62	90	17.95	140	38.90
70	11.40	100	21.56	150	44.
80	14.58	120	29.70	180	62.13

Table of the constant number for different velocities.

D represents diameter of pipe, in inches, and *c* the constant number for their diameters.

D	*c*	*D*	*c*	*D*	*c*
4	.028	6	.078	8	.134
5	.053	7	.104		

RULE. Then when H represents the head of water, $\frac{c}{D \times C}$=H.

Example. It is required to determine what head of water would be necessary to send water through 1500 feet of six-inch pipe, to an elevation of 80 feet, and at a velocity of 180 feet per minute.

C=62.13÷ (6+*c*.078) 6.078=10.22 in. which × 15 (the number of 100 feet) =153.3 in. (12 ft. 9⅓ in.) this added to 80 gives 92 ft. 9⅓ in., answer.

The time occupied in an equal quantity of water through a pipe or sewer of equal length and with equal falls, is proportionately as follows: In a right line, as 90, in a true curve, as 100 and in a right angle as 140.

Velocity of Streams and Resistance of Soils.

Ordinary nature of current.	Velocity In Feet per Sec.	Velocity In Miles per Hour.	Materials that resist these velocities and yield to more powerful ones.
Very Slow	0.25	0.171	Wet Ground—Mud.
Gliding	0.50	0.341	Soft Clay.
Gentle	1.00	0.682	Sand.
Regular	2.00	1.364	Gravel.
Ordinary Velocity	3.00	2.046	Stony.
Rapid Floods	3.35	2.284	Broken Stones, Flints, etc.
Rapid Floods, (extraordinary)	3.50	2.380	Collected Boulders, soft Schistose.
Torrents and Cataracts	9.86	6.723	Hardened Rock.

The force of running water against an object, increases as the square of the velocity.

The transporting power of water varies as the 6th power of its velocity.

3	inches	per	second	will carry off fine clay.
6	"	"	"	fine sand.
8	"	"	"	coarse sand, size of linseed.
12	"	"	"	gravel.
24	"	"	"	pebbles.
36	"	"	"	angular stones size of hen eggs.

Description of a Miner's Inch of Water.

A miner's inch of water is a quantity that will flow through an inch aperture with a free discharge—and under a constant pressure of six inches above the top of the opening. An aperture 12¼x12¾ inches, under a pressure of six inches above the top of the opening will discharge 200 inches, and is the basis of all measurements where water is retailed in small quantities in the States of California and Nevada. A miner's inch will discharge a quantity of water equal to 2,250 cubic feet or about 17,000 gallons, weighing 139,500 pounds, in 24 hours. Water will hold in suspension or solution 1.670 of its entire volume; i. e., an inch of water (miner's inch) having a grade of four inches to the rod, will carry off in 24 hours a distance of ten miles, ten tons of heavy quartz, sand and iron. At one gravel mine in Nevada county, California, 25 cubic yards, or 40 tons of detritus or tailings, as the washed material is called, is moved from three to fifteen miles every 24 hours. One hundred miner's inches of water conducted through iron pipes and falling 350 feet vertically, and applied by means of a nozzle against a hurdy-gurdy wheel 16 feet in diameter, will furnish sufficient power to run an 80 stamp mill, besides carrying off all the ore which it has furnished the power to crush.—*Deadwood Times.*

Water Power of Niagara Falls.

To pump back the water which passes over Niagara Fall would require the expenditure of 17,000,000 horse power, and assuming that 3 lbs. of coal were used per hour, per horse power, there would be required an annual expenditure of 200,000,000 tons of coal.

The weight of water falling over Niagara is about 100,000,000 tons per hour, falling a depth of 150 feet.

Overshot Water-Wheel.

RULE TO ASCERTAIN POWER.—Multiply the weight of water, in lbs., discharged upon the wheel in one minute, by the height or distance, in feet, from the lower edge of the wheel to the center of the opening in the gate; divide the product by 50,000, and the quotient is the number of horses' power.

Example.—Suppose the weight of water discharged per minute is 39,000 lbs. If the height of the fall is 23 feet, the diameter of the wheel is 22, what is the power of the wheel?

22 feet less 8 inches clearance below=22' 4"=22.33. 39,000 × 22.33= 870,870 ÷ 50,000=17.41 horse-power.

RULE TO ASCERTAIN VELOCITY OF WATER AND WEIGHT PER MINUTE, IN POUNDS, DISCHARGED ON OVERSHOT WATER-WHEEL.—Extract square of height of head of water (from surface to middle of gate) and multiply by 8 if the opening is large and head small; if the reverse, multiply by 5.5; or, from 8 to 5.5 in proportion to size of opening and head of water.

Example.—The dimensions of the stream are 2 by 80 inches, with a head of 2 feet to upper surface of water. What is the velocity of the water per minute?

2 feet plus half of 2 ins.=25 ins.=2.08, the square of which is 1.44 × 6.5 (estimate of velocity)=9.36 × 60=561.60 feet.

What is its weight?

Example.—80 inches × 2 × 6739.20 inches (=561.60 feet)=1,078,272 ÷ 1728 (inches in a cubic foot)=624 cubic feet × 62½ lbs. (weight of cubic foot of water)=39,000 lbs. weight discharged in one minute.

To Find the Quantity of Water which will Flow Out of an Opening.

RULE.—Multiply the square root of the depth of the water by 5.4; the product is the velocity in feet per second; this multiplied by the area of the opening in feet will give the number of cubic feet per second.

Example. If the center of an opening is 10 feet below the surface of the water, and its area is 2 feet, what quantity of water will run out in one minute?

$\sqrt{10}$=3.16 × 5.4 × 2=34.1496 feet=(34 1-7 feet.)

Water will fall through 1 foot in ¼ second, 4 feet in ½ second, 9 feet in ¾ second, and so on—being actuated by the same laws as falling bodies.

Wire Rope for River Mining.

For Pump Ropes, especially if of a great length, the advantage of using Wire Rope is obvious. A Grip Pulley, (see pages 37 and 38) is fixed to the shaft of the water wheel and pump, a Wire Rope is used to transmit the power. (See page 50.) The fact that when spliced and put on the grip pulleys, the Wire Rope does not stretch and allow the pump to stop working, is a matter of very great moment to the river miner, saving him an immense amount of trouble and care; and those who have once experienced the loss of time and money by the filling up with water of a large and deep pit, can more fully appreciate this.

Blasting.

In small blasts 1 lb. powder will loosen 4½ tons.

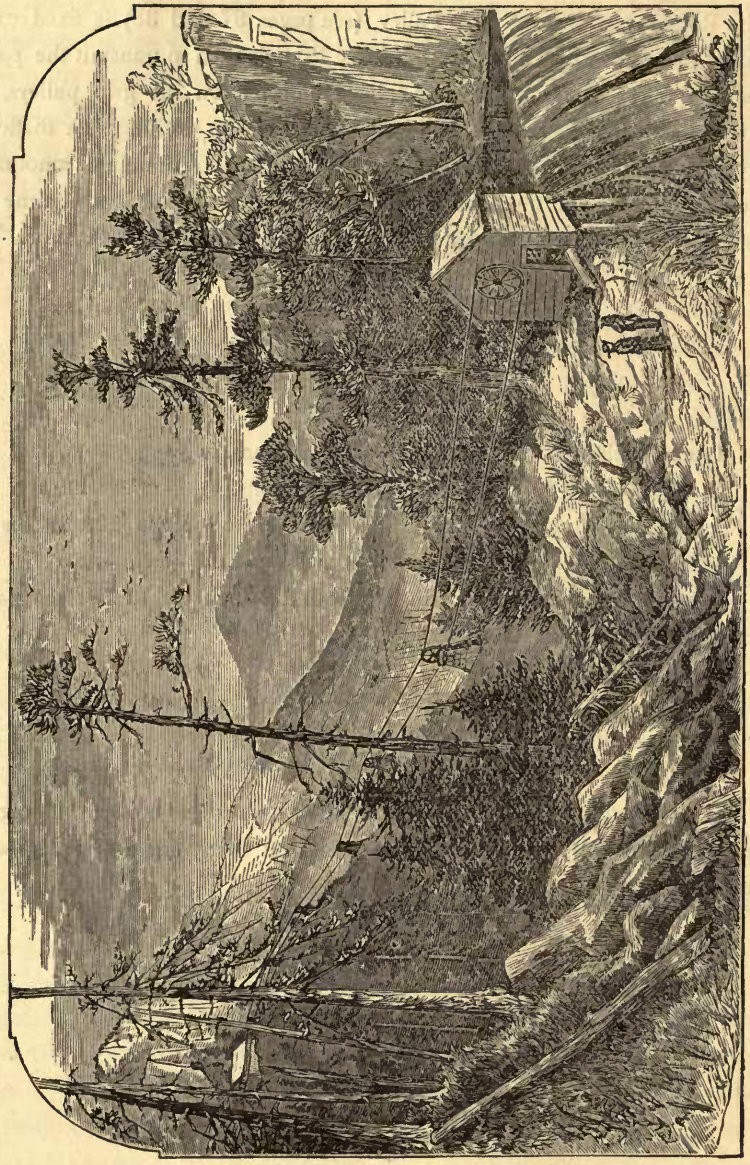
In large blasts 1 lb. powder will loosen 2¾ tons.

One man can bore with a bit 1 inch diameter from 50 to 100 inches per day of 18 hours, in granite, or 300 to 400 inches per day in limestone.

Two strikers and a holder can bore with a 2 inch bit 10 feet per day in rock of medium hardness.

Temperature of the Earth.

At the depth of 45 feet the temperature of the earth is uniform throughout the year; below this the temperature increases on the average one degree for every 53 feet.



Transmission of Power by Wire Ropes.

Transmission of Power by Means of Wire Rope.

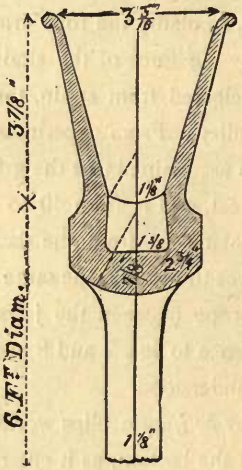
Wire Rope is employed extensively for conveying power from one point to another, as in the case of a mill situated half a mile or so from the water wheel from which power is obtained, and has been found to be very economical and durable. In France and Germany Wire Rope is used wherever an economic motive power exists and can be attached, in many cases there being 5 or 6 miles between the motive power, and the machinery to be set in motion. Considerable attention is now paid to this method of transmission, the economy and simplicity of its application are very strong recommendations in its favor. The manufacture of flexible ropes from steel wire, having great strength, with lightness and elasticity, insures the extensive application of this system. Evidently the power which can be transmitted by this plan, under given positions, depends upon the adhesion existing between the rope and the pulley, and the amount of this adhesion determines the velocity of motion of the rope, in order to transmit any given power. When, by peculiar construction of the pulley, the adhesion is made equal, or nearly so, to the strength of the rope, the velocity of the rope can be made to be quite slow, while at the same time transmitting great power. This is done by means of Grip Pulleys, where the rims of the pulleys are made up of a great number of jaws operating on the principle of the toggle joint, to clamp the rope firmly between them while they are drawn down together by the force of the strain that is put upon the rope. As soon as the rope is released from strain, the jaws open readily for its free escape as it leaves the pulley. From experiments made with Grip Pulleys of this construction, it has been ascertained that the gripping power varies with the angle at which the jaws are set, and is from 40 to 100 times the strain of the slack rope, or of the rope paying on from the slack side. The shape of that part of the jaws which receives the rope is the same as that of the rope, and since there is no slipping of the rope between the jaws, the wear upon it when in use is very slight. By reference to figs. 7 and 8 pages, 37 and 38, the operation of the clips will be readily understood.

The rope is denoted by *h*; *i*, *i* are clips working on a fulcrum *xx*. The rope pressing on the clips at the bottom, as it enters them, causes them to close over it, gripping it securely and preventing its slipping. The part of the rim, *k*, is cast separately and bolted to the main wheel, *l*, by bolts. The rim of the wheel is cast with recesses to take the jaws, fitting to them and allowing them to work freely; while the jaws cannot possibly be displaced except by removing the part *k*, which is cast separate for this purpose. From this it will be readily understood that the rope is grasped as soon as the pressure begins to act on the jaws, and is released as soon as the pressure is removed, the whole acting

automatically and invariably. For *conveying power* over long distances, this feature is of the greatest value. In this system the rope is made of strength sufficient for the transmission, and moves at velocity of from 300 to 800 feet per minute.

With the high speed system the rope is of smaller size, and travels at a velocity of from 1,500 to 6,000 feet per minute. In order to prevent the too rapid wear of the rope, the high speed pulleys are made with gutta purcha seating for the rope. A dovetailed groove is made in the rim of the pulley, into which the gutta percha is forced in the shape of small blocks, dovetailing on the sides, and having a score on the top. When the groove is filled with these blocks, they present a firm and elastic seat for the rope, giving the greatest adhesion possible under the circumstances; or, instead of using gutta percha blocks, hard rubber belting may be used, being cut in strips of sufficient depth for the dovetailed groove of the pulley, and placed side by side, so that the rope will run on the edge of the rubber belting. The strips are driven in tight and held together by being glued.

The accompanying cut shows the mode of constructing the high speed pulleys, and the advantage these have over the grip pulley is, that a much smaller rope can be used, the proportion being as the velocity of the rope.



In many places in France and Germany, vast amounts of power are transmitted. At Shaffhausen, Switzerland, the water-fall is economized through an overshot water-wheel, and by means of Wire Rope, 600 horse-power is transmitted for a distance of one mile, and thence distributed by means of other smaller Wire Ropes to various factories. The whole Pacific Coast is full of water-powers, and a knowledge of this mode of transmitting power will make many of these water privileges available.

UNIVERSITY OF CALIFORNIA.

In San Francisco there are two or three notable instances where wire rope transmission is used to great advantage. The Risdon Iron Works have used this method for many years—a steel wire rope 2¼ inches in circumference running over 10 feet sheaves at 5,000 feet per minute has transmitted 40 h. p. for six years without renewing the rope. At the Wire Mills of this Company a steel wire rope 2¼ inches in circumferance running over 8 foot sheaves has been running steadily for a period of 3 years at a velocity of 4,500 feet per minute, transmitting 80 h. p.

A table of dimensions and velocities is here inserted, which will be found convenient for reference in ascertaining the size and speed of ropes and pulleys, to transmit any given power, either by high speed and smooth pulleys, or by low speed, and grip pulleys.

Transmission Pulleys.

APPROXIMATE TABLE OF DIMENSIONS AND VELOCITIES.

	HIGH SPEED.					LOW SPEED.				
Horse Power.....	Circumference of Ropes.		Speed of Ropes in feet per minute.....	Diameter of wheel...	Revolutions of wheel..	Circumference of Ropes.		Speed of Ropes in feet per minute.....	Diameter of wheel...	Revolutions of wheel..
	Steel.	Iron.				Steel.	Iron.			
2	¾ in	1 in	1000	4	80	1 in	1½ in	400	4	32
3	⅞ in	1⅛ in	1000	4	80	1 in	1½ in	600	4	48
4	⅞ in	1⅛ in	1250	4	100	1¼ in	1⅝ in	400	4	32
5	⅞ in	1⅛ in	1500	4	120	1¼ in	1⅝ in	500	4	40
6	⅞ in	1⅛ in	1750	4	140	1¼ in	1⅝ in	600	4	48
8	1⅛ in	1⅜ in	1570	5	100	1½ in	2 in	509	6	27
10	1⅛ in	1⅜ in	1880	5	120	1⅝ in	2⅛ in	603	6	32
15	1¼ in	1½ in	2260	6	120	1⅞ in	2¼ in	416	6	22
20	1¼ in	1½ in	2420	7	110	2 in	2½ in	506	7	23
25	1¼ in	1½ in	2640	7	120	2⅛ in	2¾ in	502	8	20
30	1⅜ in	1⅞ in	2750	8	120	2⅛ in	2¾ in	603	8	24
40	1⅝ in	2 in	2260	9	80	2¼ in	2⅞ in	424	9	15
50	1⅝ in	2 in	2820	9	100	2¼ in	3 in	509	9	18
60	1⅝ in	2 in	3400	9	120	2⅜ in	3¼ in	502	10	16
80	1¾ in	2⅛ in	3800	10	120	2⅜ in	3¼ in	597	10	19
100	1¾ in	2⅜ in	3200	12	85	2½ in	3½ in	603	12	16
120	1⅞ in	2⅜ in	3260	13	80	3 in	3¾ in	603	12	16
150	2 in	2½ in	3620	14	80	3¼ in	4 in	616	14	14
200	2 in	2½ in	5280	14	120	3⅞ in	5 in	704	14	16
250	2¼ in	2¾ in	4710	15	100	4 in	5⅓ in	704	16	14
300	2¼ in	2¾ in	5650	15	120	4¼ in	6 in	704	16	14

In practice, for a distance less than 40 or 50 feet, there is not much economy in using Wire Rope, and the span between the pulleys should not exceed 400 feet; without supporting pulleys, which should not be smaller than the driving or driver pulley, and should also be rubber lined.

Instead of supporting pulleys at intervals of from 150 to 400 feet according to circumstances, and a long rope; in some cases it is more advantageous to use a series of endless ropes and double pulleys, the ropes being much shorter are more easily repaired.

For mode of splicing transmission ropes, see pages 38—40.

Patent Grip Pulleys.

These pulleys are made expressly for the purpose of transmitting power by means of Steel or Iron Wire Ropes.

By referring to the diagrams on pages 37 and 38, figs. 7 and 8, and the description on same pages, their mode of action can be readily understood.

By means of these Grip Pulleys, it is possible to transmit power from one point to another, and to the limit of the strength of the rope employed.

It will thus be seen that this arrangement is adapted for conveying power from a waterfall in a river, or where there is a large stationary engine, to any point desired, one, three or five miles distant, the Wire Rope being supported on pulleys at intervals in order to keep the rope off the ground, and lead it in the proper direction.

As a means of transmitting power from a portable steam engine to a threshing machine it enables the farmer to keep his steam engine sufficiently far from the grain to avoid conflagration.

It is the most economical and convenient mode of transmitting power, and is available for innumerable cases, and any locality, as the rope *cannot slip* in the groove, and the pulley does not wear the rope, as a concave drum, capstan, or figure of 8 pulley does.

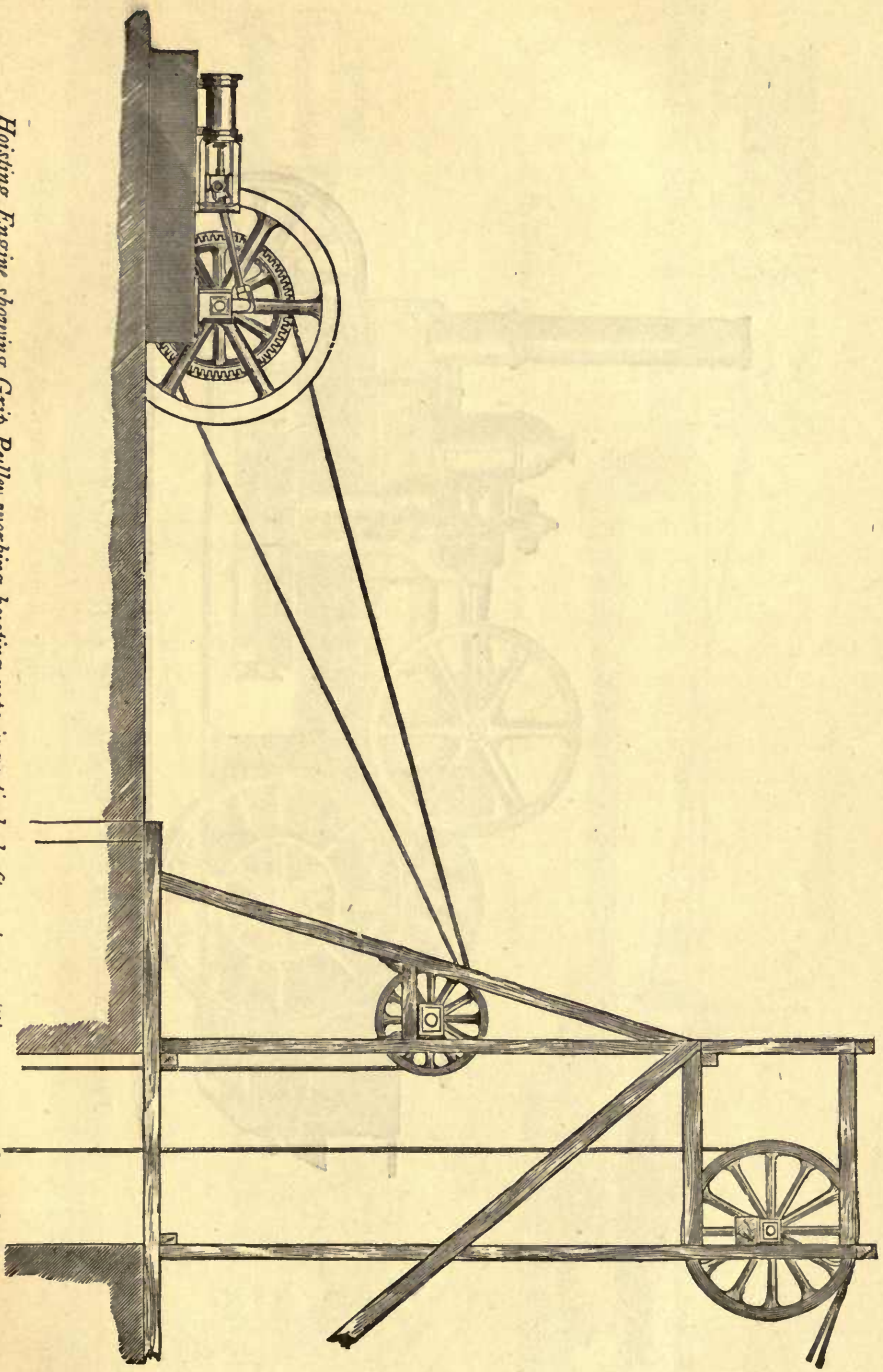
For hoisting works in a mine where a car is attached to both ends of the rope, for an incline, vertical or horizontal shaft, it is admirably adapted, economizing in machinery and wear of rope.

For steam plowing by means of ropes it works to great advantage, being much simpler in its action than any form of pulley.

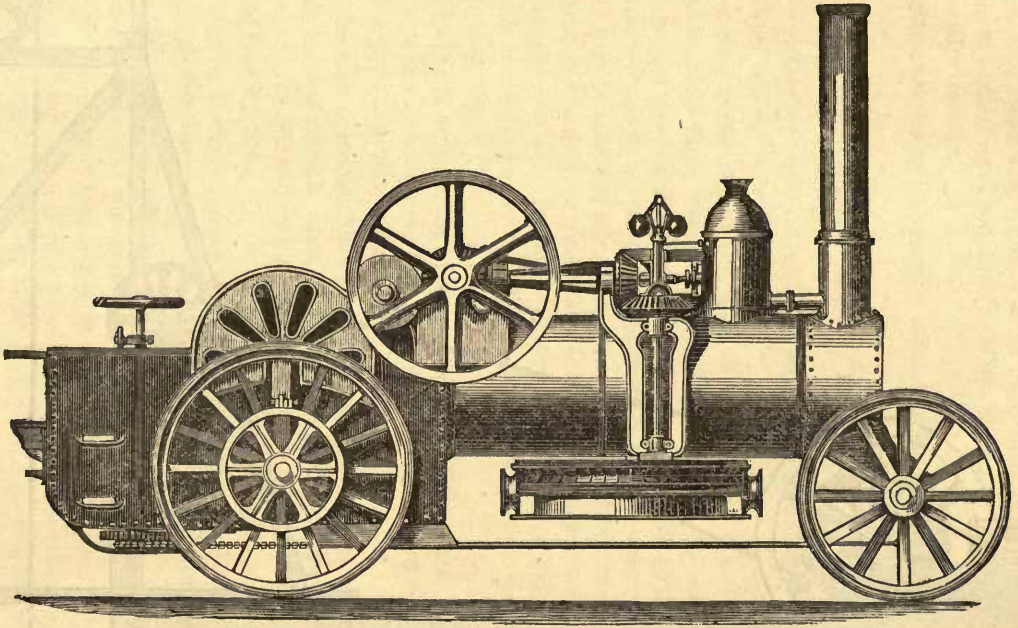
For transmitting power to rope traction, or cable street railroads, the Grip Pulleys are well suited. The Clay Street Hill R. R. Co. and the Presidio R. R. Co. employ two Grip Pulleys, side by side, for working their rope on their inclines, the ropes running at 530 feet per minute.

These pulleys are made all sizes, but the size of the grip pulley should not be less than 1,000 times the size of the wire from which the rope is made, or about 100 times the size of the rope.

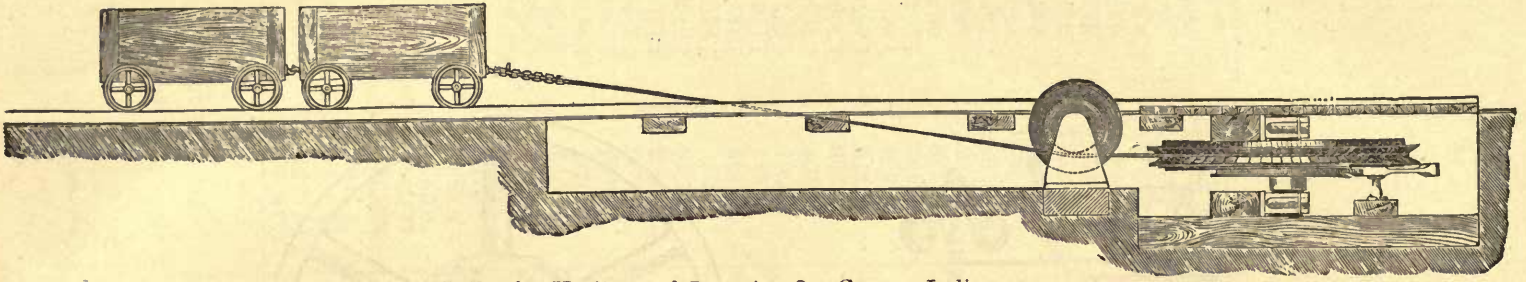
Accompanying cuts show the application of these pulleys for various purposes.



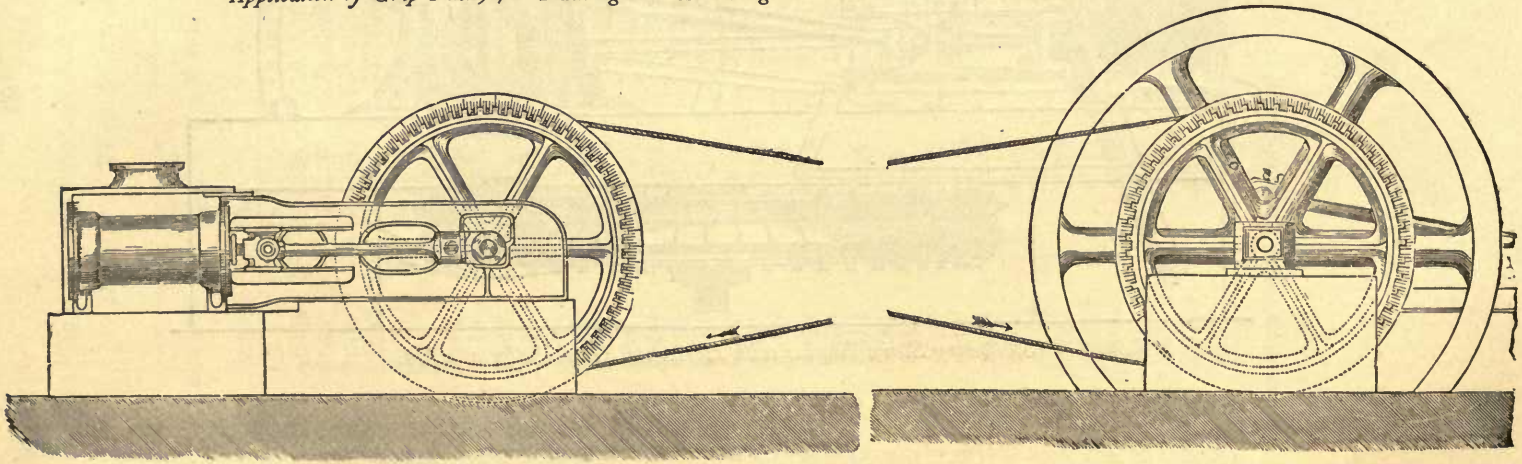
Hoisting Engine showing Grip Pulley working hoisting rope in vertical shaft, or transmitting power to lower levels.



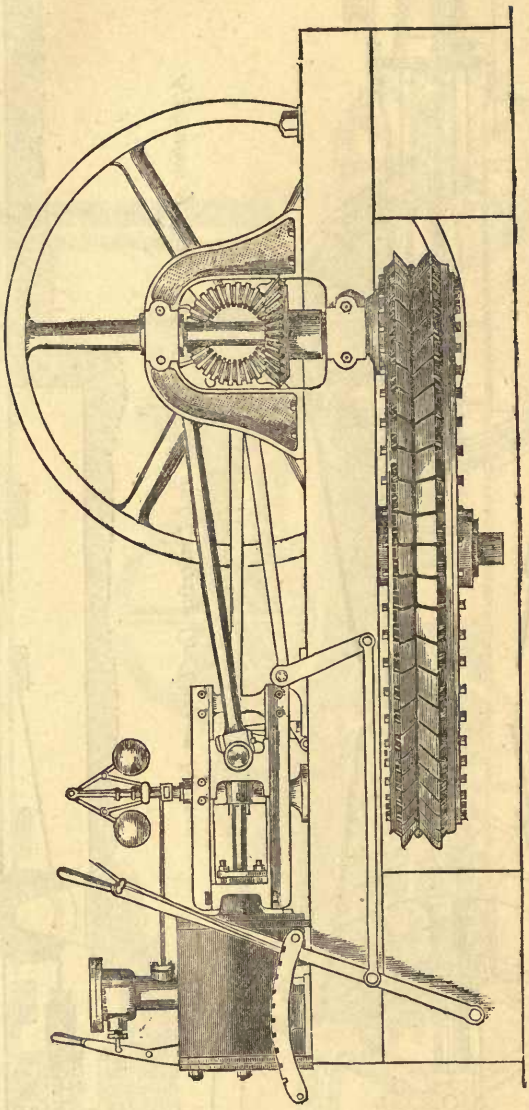
Portable Steam Engine with Grip Pulley, for Transmitting Power, Steam Plowing, etc.



Application of Grip Pulley for Hauling and Lowering Ore Cars on Inclines.



Application of Grip Pulleys for Transmitting Power.



Stationary Steam Engine with Horizontal Grip Pulley attached.

Weight per square foot of sheets of different metals:

Thickness by Sharp & Brown's Gauge.

GAUGE.	THICKNESS.	WROUGHT IRON.	STEEL.	COPPER.	BRASS.
	INCH.	LBS.	LBS.	LBS.	LBS.
0000	.46	18.4575	18.7036	20.838	19.688
000	.40964	16.4368	16.6559	18.5567	17.5323
00	.3648	14.6376	14.8328	16.5254	15.6134
0	.3248	13.0351	13.2088	14.7162	13.904
1	.2893	11.6082	11.7629	13.1053	12.382
2	.2576	10.3374	10.4752	11.6706	11.0266
3	.2294	9.2055	9.3283	10.3927	9.8192
4	.2043	8.1979	8.3073	9.2552	8.7445
5	.1819	7.3004	7.3977	8.2419	7.787
6	.1620	6.5011	6.5878	7.3395	6.9345
7	.1443	5.7892	5.8664	6.5359	6.1752
8	.1285	5.1557	5.2244	5.8206	5.4994
9	.1144	4.5915	4.6527	5.1837	4.8976
10	.1019	4.0884	4.1428	4.6156	4.3609
11	.0907	3.641	3.6896	4.1106	3.8838
12	.0808	3.2424	3.2856	3.6606	3.4586
13	.0712	2 8874	2.9259	3.2598	3.0799
14	.0641	2.5714	2.6057	2.903	2.7428
15	.0571	2.2899	2.3204	2.5852	2.4425
16	.0501	2.0392	2.0664	2.3021	2.1751
17	.0452	1.8159	1.8402	2.0501	1.937
18	.0403	1.6172	1.6387	1.8257	1.725
19	.0359	1.44	1.4593	1.6258	1.5361
20	.0312	1 2824	1.2995	1.4478	1.3679
21	.0285	1.142	1.1573	1.2893	1.2182
22	.0253	1.017	1.0306	1.1482	1.0849
23	.0226	.9057	.9177	1.0225	.96604
24	.0201	.8065	.8173	.91053	.86028
25	.0179	.7182	.7278	.81087	.76612
26	.0159	.6396	.6481	.72208	.68223
27	.0142	.5696	.5772	.64303	.60755
28	.0126	.5072	.514	.57264	.54103
29	.01126	.4517	.4577	.50994	.4818
30	.0100	.4023	.4076	.45413	.42907
31	.00893	.3582	.363	.40444	.38212
32	.00795	.319	.3232	.36014	.34026
33	.00708	.2841	.2879	.32072	.30302
34	.0063	.2529	.2563	.28557	.26981

For comparative thickness of gauge, see following page.

For the guidance of those using or requiring wire for particular purposes, the following table of the different gauges in use, may be of advantage:

Nos.	Worcester. Diameter.	Trenton. Diameter.	Birmingham. Diameter.	Brown & Sharp. Diameter.
	Inches.	Inches.	Inches.	Inches.
0	.323	.305	.331	.32486
1	.283	.285	.300	.28930
2	.263	.265	.280	.25763
3	.244	.245	.260	.22942
4	.225	.225	.240	.20431
5	.207	.205	.220	.18194
6	.192	.190	.200	.16202
7	.177	.175	.185	.14428
8	.162	.160	.170	.12849
9	.148	.145	.155	.11443
10	.135	.130	.140	.10189
11	.120	.1175	.125	.09074
12	.105	.105	.110	.08080
13	.091	.0925	.095	.07196
14	.080	.080	.085	.06408
15	.072	.070	.075	.05706
16	.063	.061	.050	.0508
17	.054	.0525	.045	.0452
18	.047	.045	.040	.0403
19	.041	.038	.035	.0359
20	.035	.033	.030	.03196

The Gauge in use at our Wire Mills is the Worcester Gauge.

In ordinary wire, when great accuracy is requisite, the *diameter* desired should be given.

Iron Wire.

Its Size, Area, Strength, Weight and Length.

Wire up to 19 is usually put up in bundles weighing 63 lbs. Smaller than 19 is put up in bundles or stones weighing 12 lbs.

The strength of the wires on the following page is taken at 80,000 lbs. per square inch; and the table of ultimate strength, is for hard or bright wire. Annealing or softening reduces the tensile strength about 40 per cent.

Table showing Size, Weight and Length of Iron Wire (Worcester Gauge).

Gauge Nos.	Diameter Inches.	Area Square inch.	Ultimate Strength in lbs.	Weight of 100 feet. lbs.	Wt. of 1 mile. lbs.	Feet in 63 lbs. Feet.	Feet in 2,000 lbs. Feet.
0000	.393	.121300	9,704	40.94	2163.	154	4,885
000	.362	.102900	8,232	34.73	1834.	181	5,759
00	.331	.086040	6,883	29.04	1533.	217	6,886
0	.323	.081930	6,754	27.66	1460.	228	72,30
1	.283	.062900	5,032	21.23	1121.	296	9,425
2	.263	.054320	4,345	18.34	968.	343	10,905
3	.244	.046759	3,741	15.78	833.	399	12,674
4	.225	.039760	3,181	13.39	707.	470	14,936
5	.207	.033653	2,692	11.35	599.	555	17,621
6	.192	.028952	2,312	9.73	514.	647	20,555
7	.177	.024605	1,968	8.03	439.	759	24,906
8	.162	.020612	1,648	6.96	367.	905	28,734
9	.148	.017203	1,376	5.08	306.	1,086	34,483
10	.135	.014313	1,144	4.83	255.	1,304	41,408
11	.120	.011309	904	3.82	202.	1,649	52,356
12	.105	.008659	693	2.92	154.	2,158	68,493
13	.092	.006647	532	2.24	118.	2,813	89,286
14	.080	.005260	421	1.69	89.	3,728	118,343
15	.072	.004071	328	1.37	72.	4,598	145,985
16	.063	.003117	248	1.05	55.	6,000	190,476
17	.054	.002290	184	.77	41.	8,182	259,740
18	.047	.001734	138	.58	31.	10,862	344,827
19	.041	.001320	105	.45	24.	14,000	444,444
						Ft. in 12 lb	
20	.035	.000963		.32	17.	3,750	625,000
21	.032	.000803		.27	14.	4,444	740,741
22	.028	.000615		.21	11.	5,714	952,381
23	.025	.000491		.17	9.	7,059	1,176,500
24	.023	.000415		.14	7.4	8,571	1,428,580
25	.020	.000314		.11	5.8	10,909	1,818,180
26	.018	.000254		.085	4.5	14,117	2,352,940
27	.017	.000227		.076	4.0	15,790	2,631,580
28	.016	.000201		.067	3.54	17,910	2,986,560
29	.015	.000176		.059	3.11	21,340	3,390,000
30	.014	.000154		.052	2.75	23,080	3,846,150
31	.013	.000133		.045	2.38	26,666	4,444,444
32	.012	.000113		.038	2.00	31,600	5,263,160
33	.011	.000095		.032	1.69	37,500	6,250,000
34	.010	.000078		.026	1.37	46,154	7,692,310
35	.0095	.000071		.024	1.27	50,000	8,333,333
36	.009	.000064		.022	1.16	54,545	9,090,909
37	.0085	.000057		.019	1.03	63,160	10,526,520
38	.008	.000050		.017	.897	70,600	11,764,700
39	.0075	.000044		.015	.792	80,000	13,333,333
40	.00725	.000041		.014	.739	85,715	14,285,710

Measure of Rock, Earth, Etc.

25 cubic feet of sand equal 1 ton.

18 cubic feet of earth equal 1 ton.

17 cubic feet of clay equal 1 ton.

13 cubic feet of quartz, unbroken in lode, equal 1 ton.

18 cubic feet of gravel or earth, before digging, equal 27 cubic feet when dug.

20 cubic feet of quartz broken (of ordinary fineness coming from the lode), equal 1 ton contract measurement.

Quantity and Cost of Excavating, Hauling, Etc.

One man can shovel into a cart per day of 10 hours,

10 cubic yards of hard ground, as gravel and clay mixed.
12 " " loam, sand and clay.
14 " " sandy soil.
} Measured in the bank.

One man can pick and loosen ready for shoveling per day of 10 hours,

18 to 22 cubic yards, common earth.
9 " " compact earth, clay and stony.

One man can excavate and throw 6 to 12 feet,

8 to 12 cubic yards common earth.
4 " " compact "

One man can wheel on a level 100 feet,

20 to 33 cubic yards compact earth.
24 to 28 " " " gravel.

Transporting earth under 100 feet the wheelbarrow is cheaper.
" " over 100 and under 500 feet, one horse cart is cheaper.
" " " 500 feet, ox cart is cheaper.

For every foot vertical rise cost 24 to 1 for wheelbarrow, 14 to 1 for horse cart.

Rock excavated increases in bulk about one half.

Light sandy soil shrinks one eighth.

Yellow clayey earth shrinks one tenth.

Gravelly earth shrinks one twelfth.

To ascertain cost of hauling by horse cart for distances as follows:

For	300	feet	divide	wages of cart and driver	by	24
"	500	"	"	"	"	19
"	1,000	"	"	"	"	12
"	1,500	"	"	"	"	9
"	2,000	"	"	"	"	7
"	2,500	"	"	"	"	6
"	3,000	"	"	"	"	5

Will give cost of hauling per cubic yard.

Example.—Suppose wages of driver $2.50, horse and cart $1.25, total $3.75, 2,000 feet will cost $3.75, divided by 7=53 4-7 cts per cubic yard.

From experiments made, the comparative cost of loading, hauling and dumping easy dirt was as follows:

Distance. Feet.	Wheelbarrow. Per cubic yard.	One Horse Cart. Per cubic yard.	Ox Cart. Per cubic yard.
30	11 cts.	16.4 cts.	17.2 cts.
60	13.8	16.8	17.6
90	16.4	17.2	17.8
120	19	17.6	18.2
150	21.8	18	18.6
300	35	20	20.2
600	61.6	24	23.6
900	88.2	28	26.8
1,200	114.8	32	30.2
1,500	141.4	36	33.6

Wages being, laborer $2.00, horse, cart and driver $2.68, ox team and driver $3.20 per day, ploughing cost $1\frac{1}{8}$ cts per cubic yard.

Notes on Warming and Heating Rooms.

100 cubic feet of space to be heated require 1 square foot of heating surface of pipe and coils. When difference of temperature outside and in is 69° f., $3\frac{1}{8}$ square feet of surface will condense 1 lb. of steam per hour, 1 lb. coal evaporates 8 lbs. water, then $8 \times 3\frac{1}{8} = 25$ sq. feet heating surface $\times 100 = 2500$ cubic feet of space heated per hour.

If 3 lbs. coal are required per h. p. per hour, then 1 h. p. will distribute exhaust steam to heat 7,500 cubic feet of space. Allowance must be made for pipes to expand $\frac{1}{8}$ inch for 8 feet in length$=\frac{1}{64}$.

Divide heating surface by 400=proper area of pipe; thus, if heating surface is 1,200, size of pipe will be 3" area or 2" diameter. 1 superficial foot of steam pipe is required for each 6 feet of glass in windows, and for each 6 cubic ft. of air escaping through ventilators, and for each 120 superficial feet of wall and ceiling, 1 cubic foot of boiler required for each 2,000 cubic feet of space to be heated. 1 h. p. boiler is sufficient for 50,000 cubic feet of space, steam c 112°.

Cable Railroads,

The invention of Mr. A. S. Hallidie, were first constructed in the City of San Francisco in 1873, on Clay Street, which runs west from Kearny Street to the top of Russian Hill, reaching an elevation of 307 feet in a distance of 2,800 feet.

The grades on Clay Street are very irregular, varying from 1 in 28 to 1 in 6½, with several cross streets which are level at the crossings.

The principles of its construction and operation are as follows: An ordinary double track is laid on the street flush with the surface; between each track and below the surface of the street a channel or tube is constructed about 2 feet deep by 16 inches wide, on the crown of which is an opening or slot ¾ inch wide running the entire distance of the tube. In the tubes are placed, about 40 feet apart, iron sheaves for a rope to run on, and at the places where the angle of the street changes upwards, similar sheaves of small diameter are placed to keep the rope down and to prevent it striking the crown of the tube.

A wire rope, which is made endless by splicing, is placed in the tubes and around large horizontal sheaves at the ends of the track and the driving drum, which is situated in the engine house. When the driving drum in the engine house is set in motion it sets the rope in the tubes also in motion, the rope running on the sheaves up one tube and down the other.

By connecting the moving rope to a car on the track in the street above, the car will of course be hauled along.

To effect this a certain apparatus is provided called a gripper, which can be connected with or disconnected from the moving rope at will. The gripper is provided with a shank about ⅝ inch thick, which passes down through the opening in the crown of the tube, the gripping jaws being under the tube and the machinery for actuating the jaws being on the floor of the car at a convenient height for the man in charge to control.

By reference to the accompanying engravings this will be better understood.

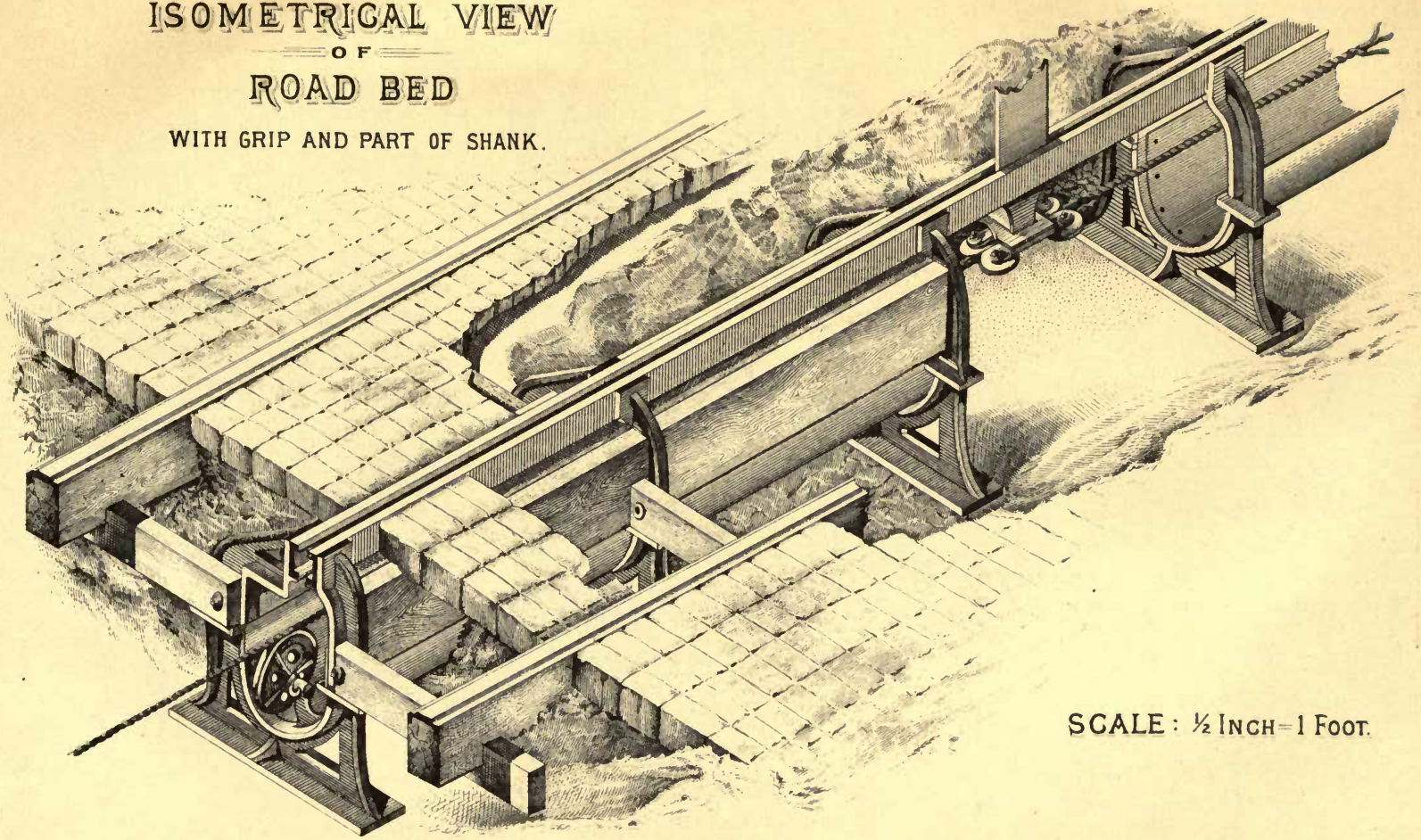
This system has up to this time (October, 1882) been adopted by seven different companies, five in San Francisco, one in Chicago and one in Dunedin, New Zealand. They are all working successfully and effect a saving in operating of from 25 to 60 per cent. on horse cars, freeing the streets from the unhealthy deposit of the horses, saving wear and tear on the streets, furnishing an agreeable and pleasant mode of traveling, and enabling one to travel up the steepest streets without any need of compassion for overloaded, struggling horseflesh, or fear of being stuck on the heavy grades.

The patents in the United States are controlled by a corporation called the Cable Railway Co., whose headquarters are in San Francisco.

The ropes for nearly all the roads are made at our works; some of the ropes made by us have worn over two years.

ISOMETRICAL VIEW
OF
ROAD BED

WITH GRIP AND PART OF SHANK.



SCALE: ½ INCH=1 FOOT.

SECTION THROUGH DUMMY & ROAD BED

SHOWING CABLE AND GRIPPING ATTACHMENT.

LIBRARY OF THE UNIVERSITY OF CALIFORNIA.

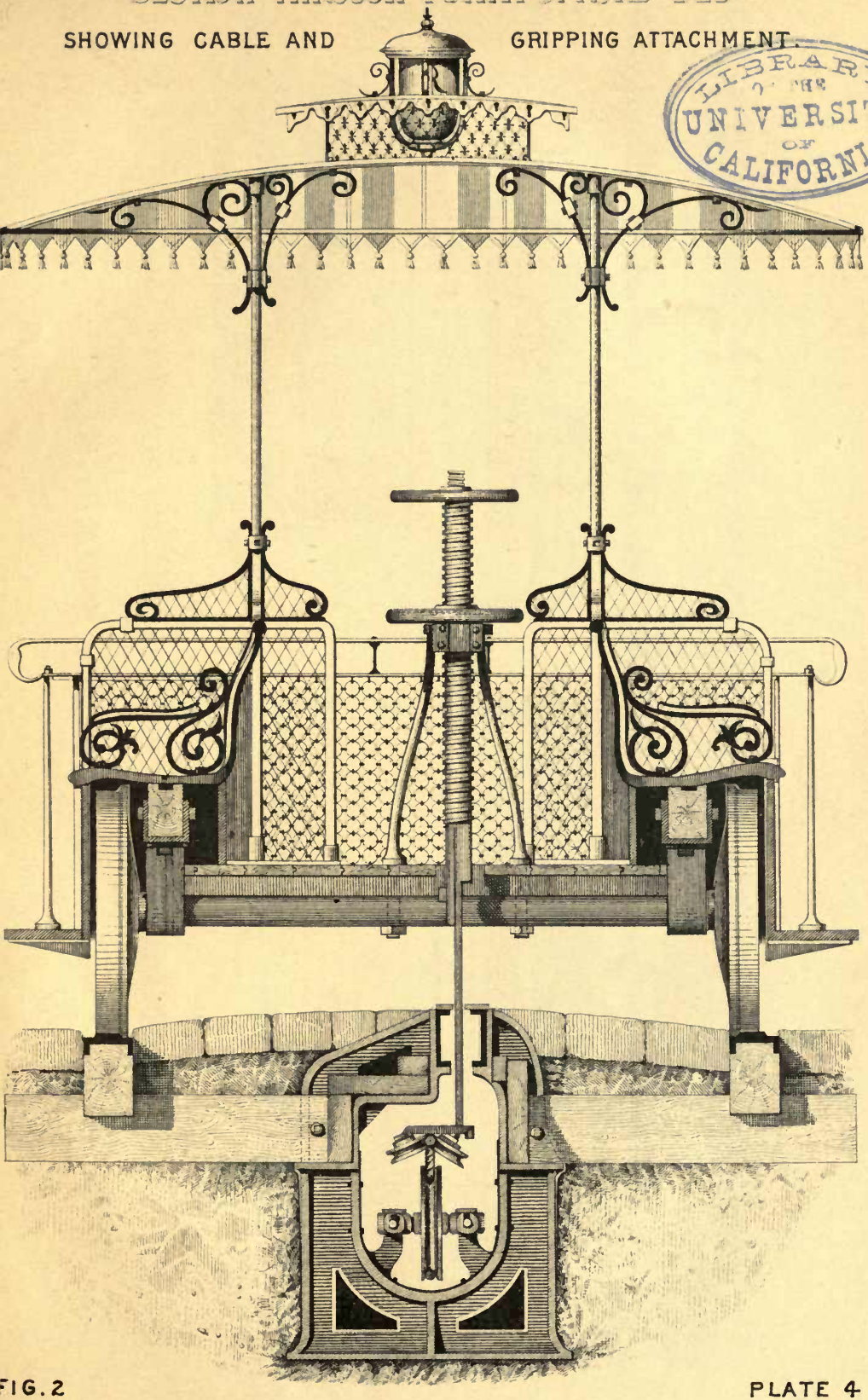
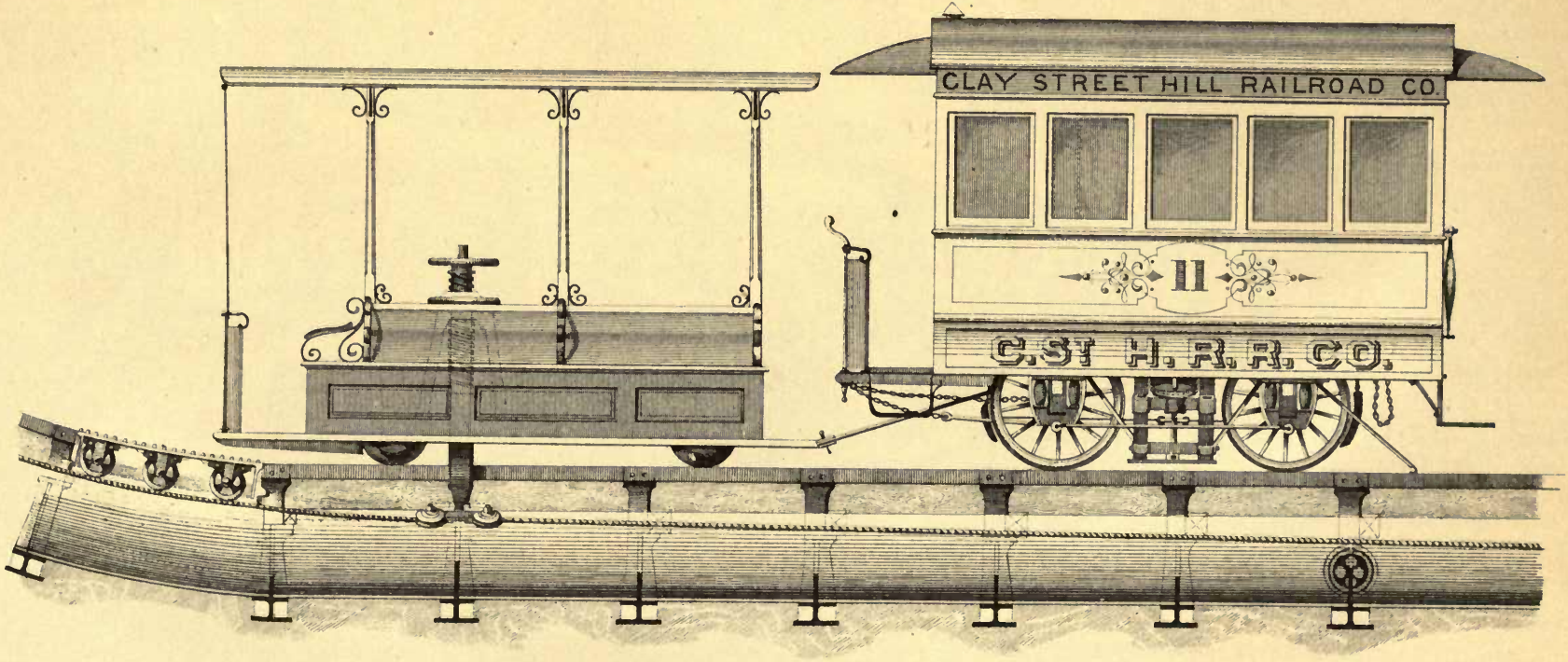


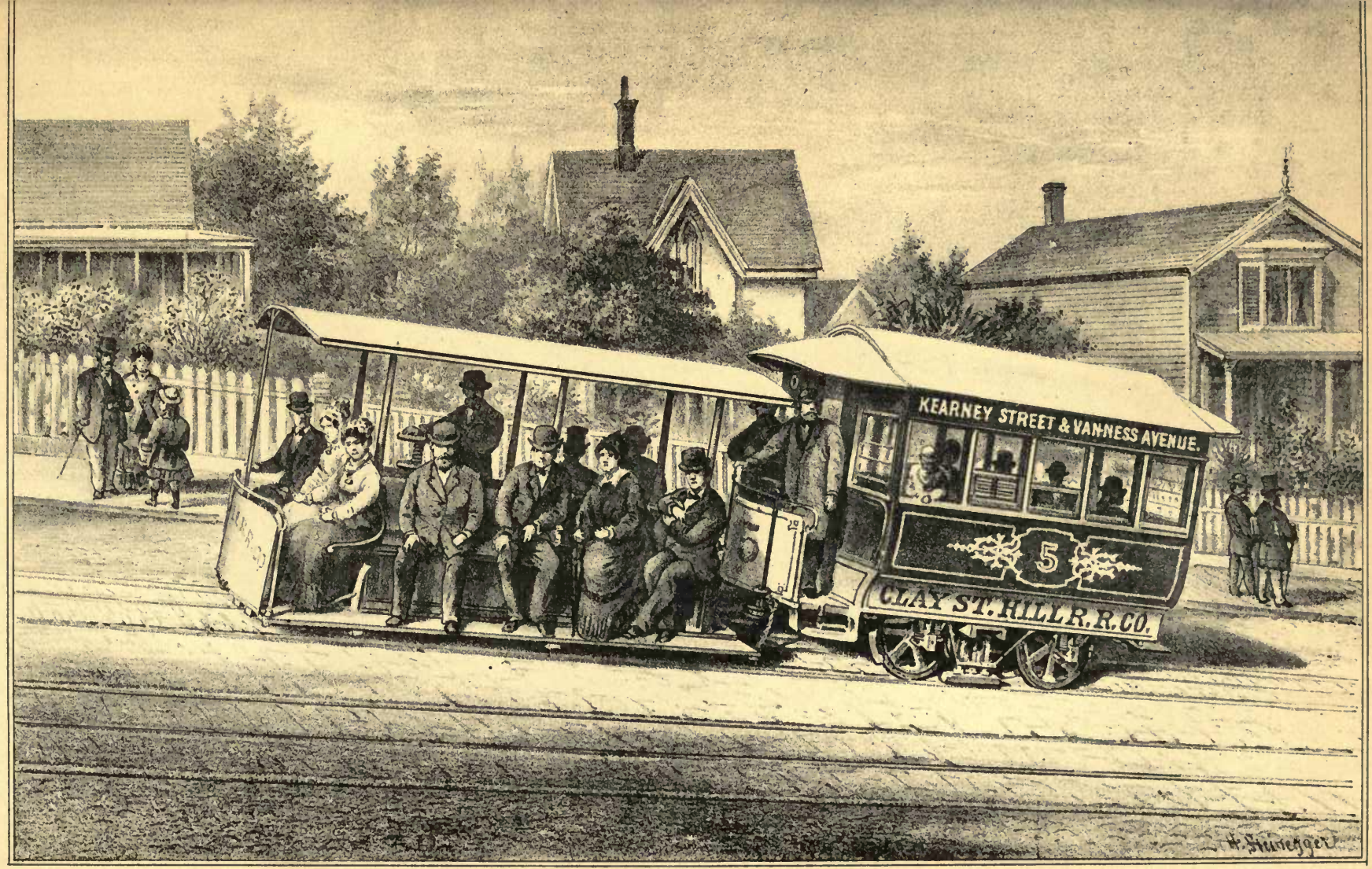
FIG. 2

PLATE 4

PASSENGER CAR AND DUMMY,

WITH GRIPPING ATTACHMENT, WIRE ROPE AND SIDE SECTION OF TUBE.



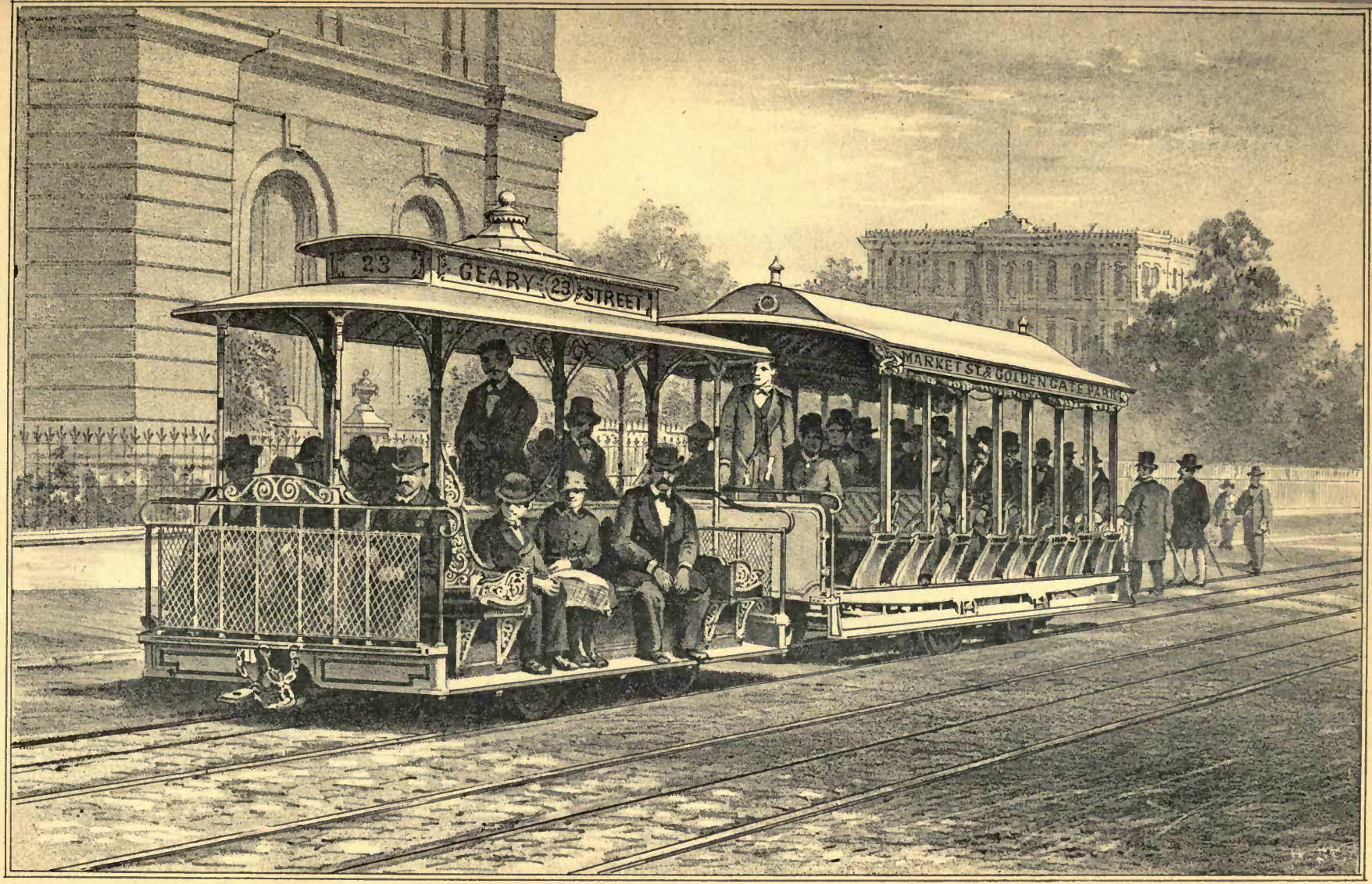


LITHO. BRITTON & REY, S.F.

CLAY STREET HILL WIRE ROPE RAIL ROAD.

ASCENDING AN ENCLINE OF ONE FOOT IN SIX. — THE FIRST CABLE ROAD CONSTRUCTED.

CITY OF DETROIT PUBLIC LIBRARY



LITHO. BRITTON & REY, S.F.

GEARY STREET WIRE ROPE RAIL ROAD.

MUCH OF THE TRACK OF THIS COMPANY WAS FORMERLY, AND IS NOW USED BY THE HORSE CARS OF OTHER COMPANIES

LIBRARY OF THE UNIVERSITY OF CALIFORNIA.

Weight of Bar Iron.

Square, from $\frac{3}{8}$ to $2\frac{1}{2}$ inch, and 1 foot long.

Size in Inches.	Weight in Lbs.	Size in Inches.	Weight in Lbs.	Size in Inches	Weight in Lbs.	Size in Inches.	Weight in Lbs.
$\frac{3}{8}$	.475	$\frac{7}{8}$	2.588	$1\frac{3}{8}$	6.390	$1\frac{7}{8}$	11.880
$\frac{1}{2}$	.845	1	3.380	$1\frac{1}{2}$	7.604	2	13.520
$\frac{5}{8}$	1.320	$1\frac{1}{8}$	4.278	$1\frac{5}{8}$	8.926	$2\frac{1}{4}$	17.112
$\frac{3}{4}$	1.901	$1\frac{1}{4}$	5.280	$1\frac{3}{4}$	10.352	$2\frac{1}{2}$	21.120

Round Bar, from $\frac{3}{8}$ to $2\frac{1}{2}$ inches diameter and 1 foot long.

Diameter.	Wght. in lbs.	Diameter.	Wght. in lbs.	Diameter.	Wght. in lbs.	Diameter.	Wght. in lbs.
$\frac{3}{8}$	.373	$\frac{7}{8}$	2.032	$1\frac{3}{8}$	5.019	$1\frac{7}{8}$	9.333
$\frac{1}{2}$	.666	1	2.654	$1\frac{1}{2}$	5.972	2	10.616
$\frac{5}{8}$	1.043	$1\frac{1}{8}$	3.360	$1\frac{5}{8}$	7.010	$2\frac{1}{4}$	13.440
$\frac{3}{4}$	1.493	$1\frac{1}{4}$	4.172	$1\frac{3}{4}$	8.128	$2\frac{1}{2}$	16.680

Flat Bar from $\frac{3}{4}$x$\frac{1}{8}$ to 5x1 *and* 1 *foot long.*

Size in Inches.	Weight in Lbs.	Size in Inches.	Weight in Lbs.	Size in Inches.	Weight in Lbs.	Size in Inches.	Weight in Lbs.
$\frac{3}{4}$x$\frac{1}{8}$	0.316	$1\frac{5}{4}$x$\frac{1}{4}$	1.479	$2\frac{1}{2}$x$\frac{3}{8}$	3.168	$3\frac{1}{2}$x$\frac{1}{4}$	2.957
$\frac{3}{4}$x$\frac{1}{4}$	0.633	$1\frac{3}{4}$x$\frac{3}{8}$	2.218	$2\frac{1}{2}$x$\frac{1}{2}$	4.224	$3\frac{1}{2}$x$\frac{3}{8}$	4.436
$\frac{3}{4}$x$\frac{3}{8}$	0.950	$1\frac{3}{4}$x$\frac{1}{2}$	2.957	$2\frac{1}{2}$x$\frac{5}{8}$	5.280	$3\frac{1}{2}$x$\frac{1}{2}$	5.914
$\frac{7}{8}$x$\frac{1}{8}$	0.369	$1\frac{3}{4}$x$\frac{5}{8}$	3.696	$2\frac{1}{2}$x$\frac{3}{4}$	6.336	$3\frac{1}{2}$x$\frac{5}{8}$	7.393
$\frac{7}{8}$x$\frac{1}{4}$	0.738	2x$\frac{1}{4}$	1.689	$2\frac{3}{4}$x$\frac{1}{4}$	2.323	$3\frac{1}{2}$x$\frac{3}{4}$	8.871
1x$\frac{1}{8}$	0.422	2x$\frac{3}{8}$	2.534	$2\frac{3}{4}$x$\frac{3}{8}$	3.485	$3\frac{1}{2}$x1	11.828
1x$\frac{1}{4}$	0.845	2x$\frac{1}{2}$	3.379	$2\frac{3}{4}$x$\frac{1}{2}$	4.647	4x$\frac{1}{4}$	3.380
1x$\frac{3}{8}$	1.267	2x$\frac{5}{8}$	4.224	$2\frac{3}{4}$x$\frac{5}{8}$	5.803	4x$\frac{1}{2}$	6.759
$1\frac{1}{4}$x$\frac{1}{8}$	0.528	2x$\frac{3}{4}$	5.069	$2\frac{3}{4}$x$\frac{3}{4}$	6.970	4x$\frac{3}{4}$	10.138
$1\frac{1}{4}$x$\frac{1}{4}$	1.056	$2\frac{1}{4}$x$\frac{1}{4}$	1.900	3x$\frac{1}{4}$	2.535	4x1	13.518
$1\frac{1}{4}$x$\frac{3}{8}$	1.584	$2\frac{1}{4}$x$\frac{3}{8}$	2.851	3x$\frac{3}{8}$	2.802	5x$\frac{1}{4}$	4.224
$1\frac{1}{2}$x$\frac{1}{8}$	0.633	$2\frac{1}{4}$x$\frac{1}{2}$	3.802	3x$\frac{1}{2}$	5.069	5x$\frac{1}{2}$	8.449
$1\frac{1}{2}$x$\frac{1}{4}$	1.266	$2\frac{1}{4}$x$\frac{5}{8}$	4.750	3x$\frac{5}{8}$	6.337	5x$\frac{3}{4}$	12.673
$1\frac{1}{2}$x$\frac{3}{8}$	1.900	$2\frac{1}{4}$x$\frac{3}{4}$	5.703	3x$\frac{3}{4}$	7.604	5x1	16.897
$1\frac{1}{2}$x$\frac{1}{2}$	2.535	$2\frac{1}{2}$x$\frac{1}{4}$	2.112	3x1	10.138		

To convert into weight of other metals, multiply the above for Cast Iron by .93; for Steel × 1.01; for Copper × 1.15; for Brass × 1.09; for Lead × 1.48; for Zinc × .92.

Weight of Sheet and Plate Iron.

THICKNESS BY BIRMINGHAM WIRE GAUGE AND INCHES. WEIGHT OF A SQUARE FOOT IN POUNDS.

THICKNESS.		Weight, Pounds.	THICKNESS.		Weight, Pounds.
B. W. Gauge.	Part of an inch.		B. W. Gauge.	Part of an inch.	
36	.004	.126	11	.120	4.48
35	.005	.202		1/8 or .125	5.054
34	.007	.283	10	.134	5.426
33	.008	.322	9	.148	5.98
32	.009	.364		5-32 or .15625	6.305
31	.010	.405	8	.165	6.605
30	.012	.485	7	.180	7.27
29	.013	.526		3-16 or .1875	7.578
28	.014	.595	6	.203	8.005
27	.016	.677		7-32 or .21875	8.79
26	.018	.755	5	.22	8.912
25	.020	.811	4	.238	9.62
24	.022	.912		1/4 or .25	10.09
23	.025	1.018	3	.259	10.37
22	.028	1.137		9-32 or .28125	11.38
	1-32 or .03125	1.259	2	.284	11.525
21	.032	1.31	1	.3	12.15
20	.035	1.416		5-16 or .3125	12.58
19	.042	1.695	0	.340	13.750
18	.049	1.975		11-32 or .34375	13.875
17	.058	2.35		3/8 or .375	15.10
	1-16 or .0625	2.518	00	.380	15.26
16	.065	2.637		13-32 or .40625	16.34
15	.072	2.92	000	.425	17.125
14	.083	3.35		7-16 or .4375	17.65
	3-32 or .0937	3.78	0000	.454	18.30
13	.095	3.85		15-32 or .46075	18.90
12	.100	4.4	00000	1/2 or .50	20.00

For STEEL PLATES multiply tabular number above (for size) by 1.01.

Weight of Sheet and Plate Iron.

THICKNESS IN INCHES. WEIGHT OF A SQUARE FOOT IN POUNDS.

Inches Thick.	Lbs. per Square Foot.	Inches Thick.	Lbs. per Square Foot.	Inches Thick.	Lbs. per Square Foot.
9-16	22.5	1 3/4	70.62	3 7/8	156.51
5/8	25.21	13-16	73.14	4	161.55
11-16	27.75	7/8	75.58	1/8	166.6
3/4	30.25	15-16	78.20	1/4	171.76
13-16	32.75	2	80.75	3/8	176.71
7/8	35.26	1/8	85.75	1/2	181.77
15-16	37.75	1/4	90.81	5/8	186.79
1	40.35	3/8	95.86	3/4	191.84
1-16	42.87	1/2	100.9	7/8	196.9
1/8	45.4	5/8	105.95	5	201.85
3-16	47.9	3/4	111.	1/8	206.9
1/4	50.45	7/8	116.1	1/4	211.95
5-16	52.96	3	121.15	3/8	217.
3/8	55.45	1/8	126.21	1/2	222.05
7-16	58.01	1/4	131.26	5/8	227.01
1/2	60.52	3/8	136.32	3/4	232.15
9-16	63.05	1/2	141.37	7/8	237.2
5/8	65.56	5/8	146.41	6	242.25
11-16	68.11	3/4	151.46		

For STEEL PLATES multiply tabular number above (for size) by 1.01.

Lap-Welded American Charcoal Iron Boiler Tubes.

TABLE OF STANDARD SIZES.

External Diameter.	External Circumference.	Internal Diameter.	Internal Circumference.	Thickness.	Length of Pipe per square foot of inside surface.	Length of Pipe per square foot of outside surface.	Internal Area.	External Area.	Weight, per foot
Ins.	Ins.	Ins.	Ins.	Ins.	Feet.	Feet.	Ins.	Ins.	Lbs.
1	3.142	0.856	2.689	0.072	4.460	3.819	0.575	0.785	0.708
1¼	3.927	1.106	3.474	0.072	3.455	3.056	0.960	1.227	0.9
1½	4.712	1.334	4.191	0.083	2.863	2.547	1.396	1.767	1.250
1¾	5.598	1.560	4.901	0.095	2.448	2.183	1.911	2.405	1.665
2	6.283	1.804	5.667	0.098	2.118	1.909	2.556	3.142	1.981
2¼	7.069	2.054	6.484	0.098	1.850	1.698	3.314	3.976	2.238
2½	7.854	2.283	7.172	0.109	1.673	1.528	4.094	4.939	2.755
2¾	8.639	2.533	7.957	0.109	1.508	1.390	5.039	5.940	3.045
3	9.425	2.783	8.743	0.109	1.373	1.273	6.083	7.069	3.333
3¼	10.210	3.012	9.462	0.119	1.268	1.175	7.125	8.296	3.958
3½	10.995	3.262	10.248	0.119	1.171	1.091	8.357	9.621	4.272
3¾	11.781	3.512	11.033	0.119	1.088	1.018	9.687	11.045	4.590
4	12.566	3.741	11.753	0.130	1.023	0.955	10.992	12.566	5.320
4½	14.137	4.241	13.323	0.130	0.901	0.849	14.126	15.904	6.010
5	15.708	4.72	14.818	0.140	0.809	0.764	17.497	19.635	7.226
6	18.849	5.699	17.904	0.151	0.670	0.637	25.509	28.274	9.346
7	21.991	6.657	20.914	0.172	0.574	0.545	34.805	38.484	12.435
8	25.132	7.636	23.989	0.182	0.500	0.478	45.795	50.265	15.109
9	28.274	8.615	27.055	0.193	0.444	0.424	58.291	63.217	18.002
10	31.416	9.573	30.074	0.214	0.399	0.382	71.975	78.540	22.19

Thickness of Boiler Iron Required and Pressures Allowed by the Laws of the United States.

PRESSURE EQUIVALENT TO THE STANDARD FOR A BOILER 42 INCHES IN DIAMETER AND ¼ INCH THICK.

Thickness in 16ths.	Diameter. 34-in.	36-in.	38-in.	40-in.	42-in.	44-in.	46-in.
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
5	169.9	160.4	152.	144.4	137.5	131.2	125.5
4½	158.5	149.7	141.8	134.7	128.3	122.5	117.2
4¼	147.2	139.1	131.8	125.1	119.2	113.7	108.8
4	135.9	128.3	121.6	115.5	110.	105.	100.
3⅔	124.5	117.6	111.4	105.9	100.8	96.2	92.0
3⅓	113.2	106.9	101.3	96.2	91.7	87.5	83.0
3	101.9	96.2	91.2	82.6	82.5	78.7	75.1

Weights and Dimensions of Gas Pipes.

Inside Diameter in inches.	Outside Diameter in inches.	Weight per foot in pounds.	Inside Diameter in inches.	Outside Diameter in inches	Weight per foot in pounds.
⅛	0.40	0.24	3	3.5	7.54
¼	0.54	0.42	3½	4.0	9.05
⅜	0.67	0.56	4	4.5	10.72
½	0.84	0.85	4½	5.0	12.49
¾	1.05	1.12	5	5.56	14.56
1	1.31	1.67	6	6.62	18.77
1¼	1.66	2.25	7	7.62	23.41
1½	1.95	2.69	8	8.62	28.35
2	2.37	3.66	9	9.68	34.07
2½	2.87	5.77	10	10.75	40.64

Weight and Thickness of Boiler Iron.

1-8	inch weighs..	5	lbs. per square foot.	No. 1	Iron is.....	5-16	inch thick.
3-16	" " ..	7½	" "	No. 3	"	9-32	"
1-4	" "	..10	" "	No. 4	"	1-4	"
5-16	" "	..12½	" "	No. 5	"	7-32	"
3-8	" "	..15	" "	No. 7	"	3-16	"
7-16	" "	..17½	" "				
1-2	" "	..20	" "				

Weights and Dimensions of Lap-Welded Iron Boiler Flues.

Outside Diameter.	Thickness W. G.	Lbs. weight per foot.	Outside Diameter.	Thickness W. G.	Lbs. weight per foot.
1¼	14	1.65	3¼	11	4.15
1½	14	1.70	3½	10	5.20
1¾	13	1.85	3¾	10	5.30
2	13	2.10	4	10	5.55
2¼	13	2.30	5	9	7.1
2½	12	2.50	6	8	10.5
2¾	12	3.15	7	8	12.2
3	11	3.60			

Hoop and Scroll Iron.

NUMBER OF FEET IN A BUNDLE OF FIFTY-SIX POUNDS.

HOOP IRON.			SCROLL IRON.		
Size.		Feet in Bundle.	Size.		Bundle. Feet in
Width.	Thick.		Width.	Thick.	
⅝ inches	No. 21	815	½ inches	No. 10	240
¾ "	" 20	630	⅝ "	" 16	430
⅞ "	" 19	450	¾ "	" 14	347
1 "	" 18	360	⅞ "	" 10	190
1⅛ "	" 17	278	1 "	" 16	360
1¼ "	" 16	217	1⅛ "	" 14	290
1½ "	" 15	160	1¼ "	" 12	208
1¾ "	" 15	139	1½ "	" 10	160
2 "	" 14	110	1¾ "	" 16	310
			1¾ "	" 14	249
			⅞ "	" 12	175
			1 "	" 16	270
			1 "	" 14	216
			1 "	" 12	152

Sheet and Bar Brass.

WEIGHT IN POUNDS.

Thickness, or Diameter, or Side; Inches.	Sheets per Square Foot.	Square Bars 1 Foot Long.	Round Bars 1 Foot Long.	Thickness, or Diameter, or Side; Inches.	Sheets per Square Foot.	Square Bars 1 Foot Long.	Round Bars 1 Foot Long.
1-16	2.7	.015	.011	1 1-16	45.95	4.08	3.20
⅛	5.41	.055	.045	⅛	48.69	4.55	3.57
3-16	8.12	.125	.1	3-16	51.4	5.08	3.97
¼	10.76	.225	.175	¼	54.18	5.65	4.41
5-16	13.48	.350	.275	5-16	56.85	6.22	4.86
⅜	16.25	.51	.395	⅜	59.55	6.81	5.35
7-16	19.	.69	.54	7-16	62.25	7.45	5.85
½	21.65	.905	.71	½	65.	8.13	6.37
9-16	24.3	1.15	.9	9-16	57.75	8.83	6.92
⅝	27.12	1.4	1.1	⅝	70.35	9.55	7.48
11-16	29.77	1.72	1.35	11-16	73.	10.27	8.05
¾	32.46	2.05	1.06	¾	75.86	11.	8.65
13-16	35.18	2.4	1.85	13-16	78.55	11.82	9.29
⅞	37.85	2.75	2.15	⅞	81.25	12.68	9.95
15-16	40.55	3.15	2.48	15-16	84.	13.5	10.58
1	43.29	3.65	2.85	2	86.75	14.35	11.25

Weight of Iron, Steel, Copper and Brass Wire.

DIAMETERS AND THICKNESS DETERMINED BY AMERICAN GAUGE.

(BROWN & SHARP'S.)

No. of Gauge.	Size of each No.	Weight of Wire per 1000 Lineal Feet.			
		Wrought Iron.	Steel.	Copper.	Brass.
	Inch.	Lbs.	Lbs.	Lbs.	Lbs.
0000	.46000	560.74	566.03	640.51	605.18
000	.40964	444.68	448.88	507.95	479.91
00	.36480	352.66	355.99	402.83	380.67
0	.32486	279.67	282.30	319.45	301.82
1	.28930	221.79	223.89	253.34	239.35
2	.25763	175.89	177.55	200.91	189.82
3	.22942	139.48	140.80	159.32	150.52
4	.20431	110.62	111.66	126.35	119.38
5	.18194	87.720	88.548	100.20	94.606
6	.16202	69.565	70.221	79.462	75.075
7	.14428	55.165	55.685	63.013	59.545
8	.12849	43.751	44.164	49.976	47.219
9	.11443	34.699	35.026	39.636	37.437
10	.10189	27.512	27.772	31.426	29.687
11	.090742	21.820	22.026	24.924	23.549
12	.080808	17.304	17.468	19.766	18.676
13	.071961	13.722	13.851	15.674	14.809
14	.064084	10.886	10.989	12.435	11.746
15	.057068	8.631	8.712	9.859	9.315
16	.050820	6.845	6.909	7.819	7.587
17	.045257	5.427	5.478	6.199	5.857
18	.040303	4.304	4.344	4.916	4.645
19	.035890	3.413	3.445	3.899	3.684
20	.031961	2.708	2.734	3.094	2.920
21	.028462	2.147	2.167	2.452	2.317
22	.025347	1.703	1.719	1.945	1.838
23	.022571	1.350	1.363	1.542	1.457
24	.020100	1.071	1.081	1.223	1.155
25	.017900	0.8491	0.8571	.9699	0.9163
26	.01594	0.6734	0.6797	.7692	0.7267
27	.014195	0.5340	0.5391	.6099	0.5763
28	.012641	0.4235	0.4275	.4837	0.4570
29	.011257	0.3358	0.3389	.3835	0.3624
30	.010025	0.2663	0.2688	.3042	0.2874
31	.008928	0.2113	0.2132	.2413	0.2280
32	.007950	0.1675	0.1691	.1913	0.1808
33	.007080	0.1328	0.1341	.1517	0.1434
34	.006304	0.1053	0.1063	.1204	0.1137
35	.005614	.08366	.08445	.0956	0.9015
36	.005000	.06625	.06687	.0757	.0715
37	.004453	.05255	.05304	.06003	.05671
38	.003965	.04166	.04205	.04758	.04496
39	.003531	.03305	.03336	.03755	.03566
40	.003144	.02620	.02644	.02992	.02827
Specific Gravity.....		7.7747	7.7847	8.880	8.386
Weight per Cubic Foot.		485.874	90.45	554.988	524.16

Weight of Iron, Steel, Copper and Brass Plates.

DIAMETERS AND THICKNESS DETERMINED BY AMERICAN GAUGE.

(BROWN & SHARP'S.)

No. of Gauge.	Size of each No.	Weight of Plates per Square Foot.			
		Wrought Iron.	Steel.	Copper.	Brass.
	Inch.	Lbs.	Lbs.	Lbs.	Lbs.
0000	.46000	17.25	17.48	20.838	19.688
000	.40964	15.3615	15.5663	18.557	17.533
00	.36480	13.68	13.8624	16.525	15.613
0	.32486	12.1823	12.3447	14.716	13.904
1	.28930	10.8488	10.9934	13.105	12.382
2	.25763	9.6611	9.7899	11.671	11.027
3	.22942	8.6033	8.7180	10.393	9.8192
4	.20431	7.6616	7.7638	9.2552	8.7445
5	.18194	6.8228	6.9137	8.2419	7.787
6	.16202	6.0758	6.1568	7.3395	6.9345
7	.14428	5.4105	5.4826	6.5359	6.1752
8	.12849	4.8184	4.8826	5.8206	5.4994
9	.11443	4.2911	4.3483	5.1837	4.8976
10	.10189	3.8209	3.8718	4.6156	4.3609
11	.090742	3.4028	3.4482	4.1106	3.8838
12	.080808	3.0303	3.0707	3.6606	3.4586
13	.071961	2.6985	2.7345	3.2598	3.0799
14	.064084	2.4032	2.4352	2.9030	2.7428
15	.057068	2.1401	2.1686	2.5852	2.4425
16	.050820	1.9058	1.9312	2.3021	2.1751
17	.045257	1.6971	1.7198	2.0501	1.937
18	.040303	1.5114	1.5315	1.8257	1.725
19	.035890	1.3459	1.3638	1.6258	1.5361
20	.031961	1.1985	1.2145	1.4478	1.3679
21	.028462	1.0673	1.0816	1.2893	1.2182
22	.025347	.95051	.96319	1.1482	1.0849
23	.022571	.84641	.8577	1.0225	.96604
24	.020100	.75375	.7638	.91053	.86028
25	.017900	.67125	.6802	.81087	.76612
26	.01594	.59775	.60572	.72208	.68223
27	.014195	.53231	.53941	.64303	.60755
28	.012641	.47404	.48036	.57264	.54103
29	.011257	.42214	.42777	.50994	.48180
30	.010025	.37594	.38095	.45413	.42907
31	.008928	.3348	.33926	.40444	.38212
32	.007950	.29813	.3021	.36014	.34026
33	.007080	.2655	.26904	.32072	.30302
34	.006304	.2364	.23955	.28557	.26981
35	.005614	.21053	.21333	.25431	.24028
36	.005000	.1875	.19	.2265	.2140
37	.004453	.16699	.16921	.20172	.19059
38	.003965	.14869	.15067	.17961	.1697
39	.003531	.13241	.13418	.15995	.15113
40	.003144	.1179	.11947	.14242	.13456
Specific Gravity.....		7.200	7.296	8.698	8.218
Weight per Cubic Foot.		450.	456.	543.6	513.6

Standard Sizes of Washers.

Diam.	Size of Hole.	Thickness, Wire Gauge	Size of Bolt.	Diam.	Size of Hole.	Thickness, Wire Gauge	Size of Bolt.
½	¼	No. 18	3-16	1¾	11-16	No. 10	⅝
⅝	5-16	" 18	¼	2	13-16	" 10	¾
¾	5-16	" 16	¼	2¼	15-16	" 9	⅞
⅞	⅜	" 16	5-16	2½	1 1-16	" 9	1
1	7-16	" 14	⅜	2¾	¼	" 9	1⅛
1¼	½	" 14	7-16	3	⅜	" 9	1¼
1⅜	9-16	" 12	½	3½	½	" 9	1⅜
1½	⅝	" 12	3-16				

Number of Washers in 100 Pounds.

Size.	No. to 100 lbs.	Size.	No. to 100 lbs.	Size.	No. to 100 lbs.
⅜	5715	¾	1450	1⅛	510
½	4010	⅞	1185	1¼	415
⅝	2235	1	940	1½	335

Tables Showing Number of Rivets and Burs to the Pound.

BELT RIVETS AND BURS.

	¼	5-16	⅜	7-16	½	9-16	⅝	¾	⅞	1	1⅛	1¼	1½	Burs.
No. 7.	272	250	228	180	164	160	148	112	116	100	84	80	69	345
" 8.	276	248	208	200	178	172	152	136	110	104	96	....	....	390
" 9.	340	280	272	248	228	220	184	176	156	136	....	....	....	610
" 10.	544	448	384	340	304	300	272	238	204	....	....	....	....	716
" 12.	588	512	452	404	364	334	304	272	....	....	....	....	....	985
" 13.	996	852	532	.....	.....	.....	....	....	....	....	....	....	....	1630

Weight of Round Bolt Copper per Foot.

Diameter.	Weight per foot in length.	Diameter.	Weight per foot in length.
⅜ inch	.424 lbs.	1¼ inch	4.71 lbs.
½ "	.755 "	1⅜ "	5.71 "
⅝ "	1.17 "	1½ "	6.79 "
¾ "	1.69 "	1⅝ "	7.94 "
⅞ "	2.31 "	1¾ "	9.21 "
1 "	3.02 "	1⅞ "	10.61 "
1⅛ "	3.82 "	2 "	12.08 "

Number of Nails and Tacks per Pound.

NAILS.

Title.	Size.	No. per lb.
3 penny fine.	1⅛ inch.	760
3 " "	1¼ "	480
4 " "	1½ "	300
5 " "	1¾ "	200
6 " "	2 "	160
7 " "	2¼ "	128
8 " "	2½ "	92
9 " "	2¾ "	72
10 " "	3 "	60
12 " "	3¼ "	44
16 " "	3½ "	32
20 " "	4 "	24
30 " "	4½ "	18
40 " "	5 "	14
50 " "	5½ "	12
60 " "	6 "	10
6 " fence.	2 "	80
8 " "	2½ "	50
10 " "	3 "	34
12 " "	3¼ "	29

TACKS.

Title.	Length.	No. per lb.
1 oz.	⅛ inch.	16,000
1½ "	3-16 "	10,666
2 "	¼ "	8,000
2½ "	5-16 "	6,400
3 "	⅜ "	5,333
4 "	7-16 "	4,000
6 "	9-16 "	2,666
8 "	⅝ "	2,000
10 "	11-16 "	1,600
12 "	¾ "	1,333
14 "	13-16 "	1,143
16 "	⅞ "	1,000
18 "	15-16 "	888
20 "	1 "	800
22 "	1 1-16 "	727
24 "	1⅛ "	666

Railroad Spikes.

SIZE.		No. in 100 Lbs.	SIZE.		No. in 100 Lbs.
Length, Inches.	Thick, Inch.		Length, Inches.	Thick, Inch.	
4½	7–16	351	5½	½	237
4½	½	267	5½	9–16	193
5	⅝	473	5½	⅝	146
5	7–16	326	6	½	207
5	½	260	6	9–16	175
5	9–16	197	6	⅝	131
5	⅝	172			

Sizes of Tanks and Contents.

Diam.	Depth.	Gallons.	Diam.	Depth.	Gallons.
Ft.	Ft.		Ft.	Ft.	
12	8	6767	24	12	40607
14	9	10363	26	13	51628
16	9	13535	28	14	64481
18	10	19034	30	15	79310
20	10	23499	32	16	96253
22	11	31277	34	17	115451

Cast Iron Columns.

WEIGHT THAT CAN BE BORNE WITH SAFETY BY CAST IRON COLUMNS IN 1000 LBS.

(*Trenton Iron Works.*)

Diam. in inches.	LENGTH OF COLUMN IN FEET.										
	5 ft.	6 ft.	7 ft.	8 ft.	9 ft.	10 ft.	12 ft.	14 ft.	16 ft.	18 ft.	20 ft.
2	12.4	9.4	7.2	—	—	—	—	—	—	—	—
3	44	36	30	24	20	18	—	—	—	—	—
4	102	88	76	66	56	48	38	28	—	—	—
5	184	164	146	130	114	102	80	64	52	44	—
6	288	264	242	218	198	180	136	122	100	84	72
7	414	386	360	332	306	282	238	200	170	144	124
8	560	532	502	470	440	410	354	304	262	226	196
9	728	698	660	630	596	560	494	432	378	332	292
10	916	884	850	812	774	739	658	586	520	462	410
11	1126	1082	1056	1016	974	932	846	774	686	616	552
12	1354	1320	1281	1240	1196	1152	1056	966	878	799	720
13	—	1570	1530	1486	1440	1392	1292	1192	1094	1000	912
14	—	—	1798	1754	1706	1656	1550	1440	1332	1228	1130
15	—	—	2086	2040	1992	1940	1828	1712	1596	1482	1372

The above table is based upon the following conditions: The column must be placed precisely perpendicular; both ends must be faced exactly at a right angle with the vertical axis, and the load must be evenly distributed over the whole face.

If both ends are rounded, the weight should be reduced to one-third of the above; if one end is rounded, two-thirds should be allowed.

Shells of Boilers.

RESISTANCE TO INTERNAL OR BURSTING PRESSURE.

(*From Haswell.*)

Diameter.	Thickness.	Bursting Pressure per square inch.		Diameter.	Thickness.	Bursting Pressure per square inch.	
		Single Riveted.	Double Riveted.			Single Riveted.	Double Riveted.
Feet.	Ins.	Lbs.	Lbs.	Feet.	Ins.	Lbs.	Lbs.
2	¼	573	745	7.6	5-16	191	248
2.6	¼	458	596	7.6	⅜	229	298
3	¼	382	496	8	5-16	179	233
3.4	¼	318	414	8	⅜	215	279
3.4	5.16	398	518	8.6	5-16	168	219
3.6	¼	327	426	8.6	⅜	202	263
3.6	5-16	409	532	9	5-16	159	207
4	¼	286	372	9	⅜	191	248
4	5-16	358	465	9.6	5-16	150	196
4.6	¼	254	331	9.6	⅜	181	235
4.6	5-16	318	413	10	5-16	143	186
5	¼	229	298	10	⅜	172	224
5	5-16	286	372	10	½	229	298
5.6	¼	208	270	10.6	5-16	136	177
5.6	5-16	260	338	10.6	⅜	163	212
5.6	⅜	312	406	10.6	½	218	284
6	¼	191	248	11	⅜	156	203
6	5-16	239	311	11	½	208	271
6	⅜	286	372	11.6	⅜	149	194
6.6	5-16	220	287	11.6	½	199	259
6.6	⅜	264	344	12	⅜	143	166
7	5-16	204	266	12	½	191	248
7	⅜	245	319				

Tensile resistance of the Plates without Riveting is taken at a mean of 55,000 pounds per square inch.

The single-riveted are estimated at .5 the resistance of the plates, and the staggered riveted at .65.

Such allowances for the resistance and wear of the plates, oxydation, etc., are to be made, as the character of the metal, the nature of the services, and the circumstances of using fresh or salt water, etc., will render necessary.

In riveted plates, it is customary in practice to estimate the safe tensile resistance of the metal of a boiler or tube, when exposed to salt water, at one-fifth of its ultimate resistance or bursting pressure; and when exposed to fresh water alone, at one-fourth of it.

For Calculating the Speed of Drums and Pulleys.

PROBLEM No. I.—The diameter of the driven being given, to find its number of revolutions.

Rule.—Multiply the diameter of the driver by number of its revolutions, and divide the product by the diameter of the driven, the quotient will be the number of revolutions of the driven.

PROBLEM No. II.—The diameter and revolutions of the driver being given, to find the diameter of the driven that shall make any given number of revolutions in the same time.

Rule.—Multiply the diameter of the driver by its number of revolutions, and divide the product by the number of revolutions of the driven; the quotient will be its diameter.

PROBLEM No. III.—To ascertain the size of the driver.

Rule.—Multiply the diameter of the driven by the number of revolutions you wish it to make, and divide the product by the revolutions of the driver; the quotient will be the diameter of the driver.

N. B.—In ordering Pulleys, be careful to give the exact size of the Shaft on which they are to go; also state how you wish them finished on the face—*Flat* face for shifting belt, *Rounding* for non-shifting belt.

Tempering Steel.

(*Haswell.*)

Steel in its hardest state being too brittle for most purposes, the requisite strength and elasticity are obtained by tempering—or *letting down the temper*, as it is termed—which is performed by heating the hardened steel to a certain degree and cooling it quickly. The requisite heat is usually ascertained by the color which the surface of the steel assumes from the film of oxide thus formed. The degrees of heat to which these several colors correspond are as follows:

At 430, a very faint yellow... At 450, a pale straw color....	Suitable for hard instruments; as hammerfaces, drills, &c.
At 470, a full yellow..... At 490, a brown color	For instruments requiring hard edges without elasticity; as shears, scissors, turning tools, &c.
At 510, brown, with purple spots..... At 538, purple.....	For tools, for cutting wood and soft metals; such as plane-irons, knives, &c.
At 550, dark blue..... At 560, full blue.....	For tools requiring strong edges without extreme hardness; as cold chisels, axes, cutlery, &c.
At 600, grayish blue, verging on black	For spring-temper, which will bend before breaking; as saws, sword-blades, &c.

If the steel is heated higher than this, the effect of the hardening process is destroyed.

Wire.

We have quite recently completed a new Wire Mill, fitted up with all the latest improvements and complete in its appointments, and with capacity to turn out 3,000 tons per annum.

It has connected with it Galvanizing and Tinning works and we are prepared to manufacture any kind of wire required on this Coast, among which are the following:

Telegraph Wire,
Fence Wire,
Bridge Wire,
Bessemer Spring Wire,
Brass Wire,
Charcoal Wire,
Stone Wire,
Bright Wire,
Tinned Wire,
Broom Wire,
Telephone Wire,
Baling Wire,
Steel Wire,
Copper Wire,
Lacquered Wire,
Flat Wire,
Annealed Wire,
Reaper Wire,
Grape Wire,
Training Wire.

Special Wire, of various forms, made to order. All sizes from 000 to 40 constantly on hand and supplied to dealers on favorable terms.

Gold.

Table of the Value of an Ounce of Gold of different degrees of fineness.

Fineness.	$ cts.	Fineness.	$ cts.	Fineness.	$ cts.	Fineness.	$ cts.
750	15 50	875	18 08	894	18 48	909	18 79
760	15 71	880	18 19	895	18 50	910	18 81
770	15 91	881	18 21	896	18 52	911	18 82
780	16 12	882	18 23	897	18 54	912	18 85
790	16 33	883	18 25	898	18 56	913	18 87
800	16 53	884	18 27	899	18 58	914	18 89
810	16 74	885	18 29	900	18 60	915	18 91
820	16 95	886	18 31	901	18 62	916	18 93
830	17 15	887	18 33	902	18 64	917	18 95
840	17 36	888	18 35	903	18 66	918	18 97
850	17 57	889	18 37	904	18 68	919	18 98
855	17 67	890	18 39	905	18 70	920	19 01
860	17 77	891	18 41	906	18 72	930	19 22
865	17 88	892	18 43	907	18 74	940	19 43
870	17 98	893	18 45	908	18 77	950	19 63

Alloys and Compositions.

	Zinc.	Tin.	Copper.	Anti-mony.	Lead.	Bismuth.
Babbitt metal	.....	10.	1.	1.	.....	.....
Babbitt metal, harder	.....	89.	3.7	7.3	.....	.....
Bell metal	.....	5.	16.	.....	.....	.....
Brass, common	5.2	10.5	84.3	.....	.....	.....
Brass, common	25.	.....	75.	.....	.....	.....
Brass, common hard	6.4	14.3	79.3	.....	.....	.....
Brass, for engine bearings	.25	13.	112.	.....	.....	.....
Brass, tough, for engine work.	15.	15.	100.	.....	.....	.....
Brass, tough, for heavy bearings	5.	25.	160.	.....	.....	.....
Brass, yellow, for turning	1.	.....	2.	.....	.....	.....
Brass, for locomotive bearings	1.	7.	64.	.....	.....	.....
Brass, for straps and glands	1.	16.	130.	.....	.....	.....
Brass wire	34.	.....	66.	.....	.....	.....
Bronze, red	13.	.....	87.	.....	.....	.....
Bronze, yellow	31.2	1.6	67.2	.....	.....	.....
Bronze medals	.....	7.	93.	.....	.....	.....
Flanges to stand brazing	1.	.....	32.	.....	1.	.....
Metal to expand in cooling	.....	.....	.....	2.	9.	1.
Muntz metal	4.	.....	6.	.....	.....	.....
Pewter	.....	86.	.....	14.	.....	.....
Spelter, for brazing	1.	.....	1.	.....	.....	.....
Statuary bronze	5.	2.	90.	.....	2.	.....
Type and stereotype	.....	.....	.....	15.5	69.	15.5

In the manufacture of alloys, the most fusible metals should be melted first.

Babbitt Metal.

To make Babbitt's Metal: Melt four lbs. Copper; add by degrees, twelve lbs. Best Banca Tin, eight lbs. Regulus of Antimony, and twelve lbs. more Tin. After four or five lbs. Tin have been added, reduce the heat to a dull red, then add the remainder of the metal as above. This composition is called *hardening* for *lining;* take one lb. of this hardening and melt two lbs. Banca Tin with it.

Solders.

Solders.	Zinc.	Tin.	Copper.	Antimony	Lead.
For lead	.....	1	.....	.....	1½
" tin	.....	1	.....	.....	2
" pewter	.....	2	.....	.....	1
" brazing (soft)	3	1	4	.....	.....
" " "	.....	2	.....	1	.....
" " (hard)	1	.....	1	.....	.....
" " (hardest)	1	.....	3	.....	.....

Wire Fencing.

The most durable fence is a wire fence. The objection to a plain wire fence is, that the wire is too small to be seen by cattle; by running a board along the top this objection is removed. A wire fence made from single wires, is not so good as that made from two or more wires twisted together.

Wire strand made from seven wires twisted together, makes a very strong and durable fence, and if galvanized, will last for generations and will wear out probably fifty sets of ordinary fence posts.

We make wire strand of various sizes, and put it up on reels in one-half mile lengths, so that by putting it in a wagon it will pay off at the tail end, as the wagon is driven over the ground to be fenced in.

Recently, BARBED WIRE FOR FENCES has been introduced; this is usually two wires twisted together and having sharp points projecting every six inches, so that it pricks any animal that comes in contact with it, and warns him to keep off.

Barbed fences are very effective and cheap, and do not require so many wires, as fences made of plain wire.

Thus there are three kinds of wire fences, viz: plain wire, twisted strand and barbed, all of which we manufacture and supply at the lowest market rates, either from galvanized or black wire.

Melting Points of Alloys.

Lead 2, tin 3, bismuth 5	312°
Lead 1, tin 3, bismuth 5	210
Lead 1, tin 4, bismuth 5	240
Tin 1, bismuth 1	286
Tin 2, bismuth 1	336
Lead 2, tin 3	334
Tin 8, bismuth 1	392
Lead 2, tin 1 (solder)	475
Lead 1, tin 2 (soft solder)	360
Zinc 1, tin 1	399
Lead 1, tin 1	368
Lead 1, tin 1, bismuth 4, cadmium 1	155

75 parts of lead, 16 7-10ths parts of antimony, 8 3-10 parts bismuth, forms a metallic alloy that expands in cooling.

Pile Driving.

In sandy soil, the greatest force of a pile-driver will not drive a pile over 15 feet.

Horse Power.

A horse-power is equivalent to 33,000 lbs. raised 1 foot high in one minute.

Effect of Heat upon Various Bodies.

	Degrees.		Degrees.
Ammonia boils	140	Iron, bright red in the dark	752
Ammonia (liquid) freezes	46	" red hot in twilight	884
Antimony melts	951	Lead melts	504
Arsenic melts	365	Mercury boils	662
Bismuth melts	476	" volatilizes	680
Blood (human) heat of	98	" freezes	—39
" " freezes	25	Naphtha boils	186
Brandy freezes	—7	Petroleum boils	306
Brass melts	1900	Platinum melts	3080
Cadmium melts	600	Potassium melts	135
Coal Tar boils	325	Proof Spirit freezes	—7
Cold, greatest artificial	—166	Saltpetre melts	600
" " natural	—56	Sea-water freezes	28
Common Fire	790	Silver (fine) melts	1250
Copper melts	2548	Snow and Salt, equal parts	0
Glass melts	2377	Spirits of Turpentine freezes	14
Gold (fine) melts	2590	Steel melts	2500
Gutta-percha softens	145	" polished, blue	580
Heat, cherry red	1500	" " straw color	460
" " " (Daniel)	1141	Strong Wines freeze	20
" bright red	1860	Sulphur melts	226
" red, visible by day	1077	Sul. Acid. (sp. grav. 1.641) freezes	—45
" white	2900	Tin melts	421
Ice melts	32	Vinous fermentation	60 to 77
Iron (cast) melts	3479	Water in *vacuo* boils	98
" (wrought) melts	3980	Zinc melts	740

The sign — before the figures indicates that many degrees below zero or 0.

River Pump.

To construct and use a chain pump to the best advantage, the distance between the buckets should be equal to their breadth; and the pump barrel should have an inclination of 24° 21". With this arrangement it produces a maximum effect.

Water Required in Working Quartz.

Each stamp uses 10 pounds per minute.

Each pan uses 16 pounds per minute.

Each settler uses 9 pounds per minute.

If the water is run from the mill into settling tanks it can be saved with a loss of 20 per cent. This will make the actual supply of water required in pounds per minute to be as follows:

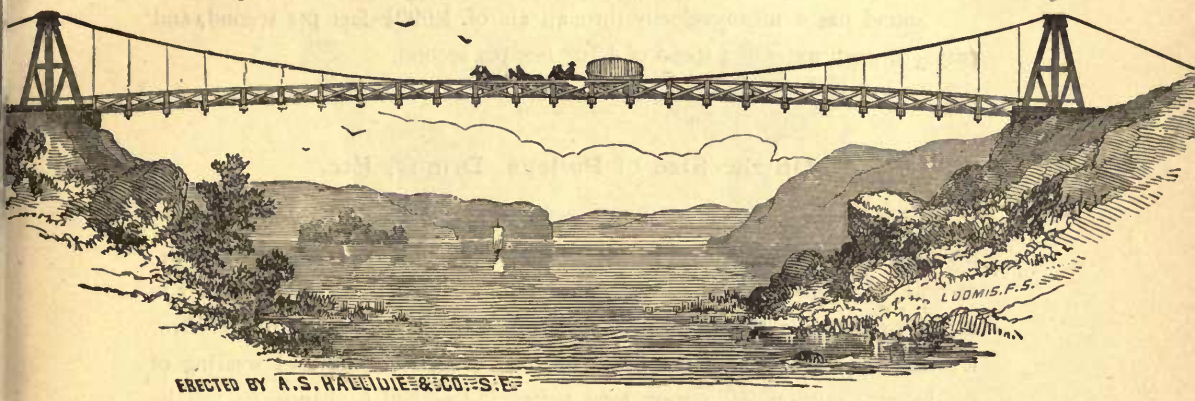
	FOR
1 Stamp	2.
1 Pan	3.2
1 Settler	1.8

Wire Suspension Bridges.

We are prepared to supply material for the erection of wire suspension bridges or to contract for their construction, having during the past twenty-two years erected a large number of such bridges on the Pacific Coast, as far north as Frazer River, B. C.

To parties about to erect Wire Suspension Bridges, we will be pleased to estimate for the same, and can guarantee excellence of workmanship and satisfaction.

Especial attention paid to cables for bridges.



Mortars and Cements.

Stone Mortar; eight parts cement, three parts lime, thirty-one parts sand.

Brick Mortar; eight parts cement, three parts lime, twenty-seven parts sand.

Brown Mortar; one part lime, two parts sand, and a small quantity of hair.

Lime and sand, and cement and sand, lessen about one-eighth in volume when mixed together.

In mixing mortar the sand should be sharp and clean, and not mixed with the lime until it is slack; the mortar should be mixed at least one week before using.

Cement for Coating Cisterns.—Mix glycerine and litharge until it becomes a thick paste, then apply; hardens quickly.

Rust Joint for Iron.—One pound sal ammonia, two pounds flour of sulphur, eighty pounds iron borings, made to a paste with water.

Cement for Cisterns or Water Casks.—Melted glue eight parts, linseed oil four parts, boiled into a varnish with litharge; hardens in forty-eight hours.

Cement for Leather Belt.—Common glue and American isinglass equal parts; placed in a glue pot; add water to cover the whole; soak ten hours; then bring the mixture to boiling head, and add tannin until the whole becomes spongy or like the white of an egg; apply warm. Buff off the leather where it is to be cemented; rub the joint surfaces solidly together; let it dry for a few hours and it is ready for use. No rivets are needed if properly cemented, as the cement is as strong as the leather.

Size of Gas Pipes.

Following is the London rule for gas pipe sizes: For two hundred lights, two inch iron tube; one hundred and twenty lights, one and one-half inch; seventy lights, one and one-fourth inch; fifty lights, one inch; twenty-five lights, three-fourths inch; twelve lights, one-half inch; six lights, three-eighths inch; two lights, one-fourth inch.

Sound.

Sound has a mean velocity through air of 1,092½ feet per second, and passes through water at a speed of 4,708 feet per second.

On the Size of Pulleys, Drums, Etc.

We cannot too strongly call the attention of the mechanic and miner to the general errors committed in proportioning the Pulley, Drum or Sheaves, of hoisting or driving gear. We would remind them that when a pulley is under a certain diameter for certain sized ropes, be the rope of Hemp or Wire, it will very soon destroy the fibres by the constant chafing and wearing of the internal portion of the rope, long before it has had a chance to test its strength or durability. An examination of any rope after running for some time on a pulley of a small diameter, will fully and clearly demonstrate the fact to the examiner; moreover, as it requires some exertion to bend a rope around a small circle, an unprofitable expenditure of power is required, and besides there is a loss of frictional surface, and this is a serious matter in driving heavy machinery, when the grip pulley is not employed; therefore, it is very essential that the diameter of the drum or pulley should be attended to, and for the guidance of those erecting such machinery, we offer them the following general rule:

Rule.—For Wire Rope, the pulley or drum should be 100 times the size of the rope, if made of six strands of seven wires; but for a flexible rope made of six strands of nineteen wires, the size of the pulley or drum may be sixty times the size of the rope. For Hemp Rope the pulley should be fifty times the size of the rope. A good general rule for Round Wire Ropes is to have the drum or pulley 1,000 times the size of the wire from which the rope is made. For Flat Iron Rope, the diameter of the barrel should be not less than 150 times the thickness of the rope.

It will be seen that the same size pulleys answer for both Wire and Hemp Rope *of the same strength.* [See Table of Comparative Strength of Ropes.]

On the Form of the Groove of Sheaves and Pulleys.

It is also important that the groove of all pulleys and sheaves should have the same form as the rope, *i. e.*, a rope one inch diameter, requires the groove to be laid out with a radius of full half an inch, so that the width will be, say, $1\frac{1}{32}$ inch, and the depth of bed $\frac{7}{16}$; the sides or flanges of the groove should be carried up sufficiently high to prevent the rope ever jumping out, and should have sufficient flare to avoid coming in contact with the rope. [See fig. A.]

A rope running on a flat, ill-fitted groove, soon becomes injured, destroying the rope and cutting into the groove. [See fig. B.]

Fig. A.

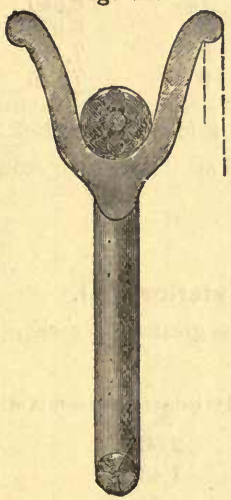
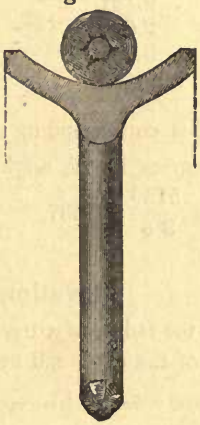


Fig. B.



Wire Cables for Suspension Flumes or Water Conduits.

For conveying water across deep gulleys, canyons, rivers, etc., with galvanized iron piping, joints, suspending rods, etc., etc., complete—the most economical way of carrying water over a deep canyon. Guaranteed to give satisfaction. Estimates given and material furnished low.

Submarine and Subterraneous Telegraph Cables.

We are prepared to manufacture and supply submarine telegraph cables of any size or length, and having erected new and improved machinery for covering the same with any size armor desired, can fill at short notice any ordinary order.

Having machinery and facilities in San Francisco, and keeping on hand or ordering through our European agency, the very best of English and German wire and insulated core, we are prepared to give estimates and contract for large orders, which we can execute in bond for export or foreign market, thereby bringing the cost of the same to the lowest figure.

Railway Curves.

Railway curves are expressed as being of such a degree of curvature, or of such a radius. The radii corresponding to the various degrees are as below:

Angle of deflections in degrees.	Tangent deflections in feet.	Radius in feet.	Angle of deflections in degrees.	Tangent deflections in feet.	Radius in feet.
½	.436	11,460	4½	3.926	1,274
1	.873	5,730	5	4.362	1,146
1¼	1.091	4,584	5½	4.798	1,042
1½	1.309	3,820	6	5.234	955
1¾	1.527	3,273	6½	5.669	882
2	1.745	2,865	7	6.105	819
2½	2.181	2,292	7½	6.540	764
3	2.618	1,910	8	6.976	716
3½	3.054	1,637	8½	7.411	674
4	3.490	1,433	9	7.846	636

The radius corresponding to any angle is found by dividing 5730 by any number of degrees in the angle of deflection. Thus, the radius for a 3½ deg. curve is $\frac{5730}{3.5}=1637$.

Elevation for the Exterior Rail.

The less the radius of curvature, and the greater the speed, the greater is the elevation of the outer rail upon a curve.

Radius of Curve in feet being	Elevation of the Outer Rail in inches; the velocity in miles per hour being 10.	20.	30.
500	0.57	2.83	8.56
1,000	0.29	1.43	3.30
2,000	0.15	0.71	1.65
3,000	0.10	0.47	1.10
4,000	0.07	0.36	0.83
5,000	0.06	0.28	0.66

It is well, in connection with the ordinary rail gauge, to use a clinometer graduated for different radii of curvature. Any trackman could use such an instrument and could carry it in his pocket. The proper elevations would thus be maintained undisturbed by the repairs of the road-bed.

Power needed to Ascend Railroad Grades.

It is a very interesting fact that a Standard engine having a sixteen inch cylinder, twenty-four inch stroke, sixty-inch driver, and weighing thirty-two and a half tons, with four drivers and four truck wheels, will easily haul:

	Tons.
On a level grade	1,000
On grade of only 20 feet to the mile	460
On grade of 60 feet to the mile	205
On grade of 80 feet to the mile	150
On grade of 100 feet to the mile	120

Strength of Animals.

Two men working at a windlas with the cranks at right angles to each other, can raise seventy pounds more easily than one man can raise thirty pounds. The mean effective power of a man, unaided by machinery, working to best advantage, is raising seventy pounds one foot high in one second for ten hours per day. The strength of a horse is equal to that of five men. A horse should be allowed four gallons of water per day. *One horse power in machinery* it estimated at 33,000 pounds, raised one foot high, in one minute. A horse can exert this power but for six hours per day, therefore one horse power steam, equals four horses.

Electrical Properties of Copper Wire.

RESISTANCE OF PURE COPPER.

(BROWN & SHARP'S GAUGE.)

Gauge.	Diameter in inches.	Pounds per 1,000 feet.	Feet in one Pound.	Ohms per 1,000 feet.	Feet per Ohm.	Ohms per Pound.	Gauge.
0	.325	319.	3.13	.102	9783.63	.00032	0
1	.289	253.	3.95	.129	7754.66	.00051	1
2	.258	200.	4.99	.163	6149.78	.00081	2
3	.229	150.	6.29	.205	4876.73	.00129	3
4	.204	126.	7.93	.259	3867.62	.00205	4
5	.182	100.	10.	.326	3067.06	.00326	5
6	.162	79.32	12.61	.411	2432.22	.00518	6
7	.144	62.9	15.9	.519	1928.75	.00824	7
8	.128	49.88	20.	.654	1829.69	.01311	8
9	.114	39.56	25.28	.824	1213.22	.02086	9
10	.102	31.37	31.88	1.040	961.91	.03314	10
11	.0907	24.88	40.20	1.311	762.93	.05269	11
12	.0808	19.73	50.7	1.653	605.03	.08377	12
13	.0720	15.65	63.9	2.084	479.80	.1332	13
14	.0641	12.41	80.6	2.628	380.51	.2118	14
15	.0571	9.84	101.63	3.314	301.75	.2368	15
16	.0508	7.81	128.14	4.179	239.32	.5255	16
17	.0452	6.19	161.5	5.269	189.78	.8515	17
18	.0403	4.91	203.75	6.645	150.50	1.354	18
19	.0354	3.78	264.25	8.617	116.05	2.277	19
20	.0320	3.	324.	10.566	94.65	3.423	20
21	.0285	2.45	408.56	13.323	75.06	5.443	21
22	.0253	1.94	515.15	16.799	50.53	8.654	22
23	.0226	1.54	650.	21.185	47.20	13.763	23
24	.0201	1.22	820.	26.713	37.43	21.885	24
25	.0179	.97	1033.	33.684	29.69	34.795	25
26	.0159	.77	1303.	42.477	23.54	55.331	26
27	.0142	.61	1643.	53.563	18.68	87.979	27
28	.0126	.48	2072.	67.542	14.81	139.89	28
29	.01126	.38	2612.	85.170	11.74	222.45	29
30	.01025	.30	3294.	107.391	9.31	353.74	30
31	.00893	.24	4152.	135.402	7.39	562.22	31
32	.00795	.19	5237.	170.765	5.86	894.24	32
33	.00708	.15	6603.	215.312	4.64	1421.65	33
34	.00634	.12	8328.	271.583	3.68	2261.82	34
35	.00561	.10	10501.	342.443	2.92	3596.1	35
36	.00500	.08	13239.	431.712	2.32	5715.36	36

THE ELASTIC FORCE OF STEAM AND CORRESPONDING TEMPERATURE OF THE WATER WITH WHICH IT IS IN CONTACT.

(*From Haswell.*)

Pressure on a Square Inch.	Elastic Force in Inches of Mercury.	Temperature of Water in Degrees of Fahrenheit.	Volume of Steam compared with the Volume of Water.	Pressure on a Square Inch.	Elastic Force in Inches of Mercury.	Temperature of Water in Degrees of Fahrenheit.	Volume of Steam compared with the Volume of Water.
lbs.				lbs.			
14.7	30.00	212.0	1700	68	138.72	304.4	419
15	30.60	212.8	1669	70	142.80	306.4	408
16	33.64	216.3	1573	72	146.88	308.4	398
18	36.72	222.7	1411	74	150.96	310.3	388
20	40.80	228.5	1281	76	155.06	312.2	379
22	44.88	233.8	1174	78	159.14	314.0	370
24	48.96	238.7	1084	80	163.22	315.8	362
26	53.04	243.3	1007	82	167.30	317.6	354
28	57.12	247.6	941	84	171.38	319.3	346
30	61.21	251.6	883	86	175.46	321.0	339
32	65.28	255.5	833	88	179.54	322.6	332
34	69.36	259.1	788	90	183.62	324.3	325
36	73.44	262.6	748	92	187.70	325.9	319
38	77.52	265.9	712	94	191.78	327.5	313
40	81.60	269.1	679	96	195.86	329.0	307
42	85.68	272.1	649	98	199.92	330.5	301
44	89.76	275.0	622	100	204.01	332.0	295
46	93.84	277.8	598	110	224.40	339.2	271
48	97.92	280.5	575	120	244.82	345.8	251
50	102.00	283.2	554	130	265.23	352.1	233
52	106.08	285.7	534	140	285.61	357.9	218
54	110.16	288.1	516	150	306.03	363.4	205
56	114.24	290.5	500	160	326.42	368.7	193
58	118.32	292.9	484	170	346.80	373.6	183
60	122.40	295.6	470	180	367.25	378.4	174
62	126.48	298.1	456	190	387.61	382.9	166
64	130.56	300.3	443	200	408.04	387.3	158
66	134.64	302.4	431				

Staples.

We manufacture wire staples of all sizes from galvanized or plain wire. These staples are pointed and cut, so that they clinch in driving.

Wire Nails.

Made from the best charcoal iron or steel wire, all lengths and sizes. Special sizes made to order.

USE OF THE TABULAR SCALE.

The accompanying Tabular Scale is so arranged that a person desiring to order a rope can do so intelligently.

The first and most essential thing to determine is the load to be lifted; this includes the weight of ore, of bucket or cage, and of rope. For example:

Ore to be raised	4,000 pounds.
Weight of cage	1,800 "
Weight of rope say 1,000 feet long	1,000 "
Total lift	6,800 pounds.

By referring to scale, it will be found that there will be required an Iron Wire Rope $3\frac{1}{2}$ inches circumference, weighing $1\frac{8}{10}$ pounds per foot, or a Crucible Steel Rope $2\frac{1}{2}$ inches circumference, weighing 1 pound per foot, or a Hemp Rope $8\frac{1}{4}$ inches circumference, weighing $2\frac{64}{100}$ pounds per foot, or a Flat Iron Rope $3x\frac{3}{8}$, weighing $2\frac{3}{10}$ pounds per foot, or a Flat Steel Rope $2x\frac{3}{8}$, weighing $1\frac{44}{100}$ pounds per foot, or an Iron Chain $\frac{3}{4}$ inch link, weighing $5\frac{1}{3}$ pounds per foot.

[For explanation, see preceding page.]

TABULAR SCALE

Showing approximately the comparative strength, sizes and weights per 100 feet in length of Iron Wire Rope, Steel Wire Rope, Hemp Rope and Chain. The sizes on each horizontal line are of equal strength.

Capacity of the Ropes and Chain.		Round Charcoal Iron Wire Rope.		Round Crucible Steel Wire Rope.		Round Hemp Rope.		Flat Charcoal Wire Rope.		Flat Crucible Steel Wire Rope.		Iron Chain.	
Working Load-Lbs.	Breaking Strain-Tons	Circum. in Inches.	Weight per 100 ft.	Circum. in Inches.	Weight per 100 ft.	Circum. in Inches.	Weight per 100 ft.	Size in Ins. wdth, thks	Weight per 100 ft.	Size in Ins. width, thkns	Weight per 100 feet	Diam of Link.	Weight per 100 ft.
300	1	1	17	—	—	$2\frac{3}{4}$	33	—	—	—	—	$\frac{1}{4}$	66
550	$1\frac{1}{2}$	$1\frac{1}{4}$	23	—	—	3	50	—	—	—	—	$\frac{5}{16}$	92
800	$2\frac{1}{2}$	$1\frac{1}{2}$	30	1	17	$3\frac{1}{4}$	55	—	—	—	—	$\frac{3}{8}$	133
1,500	$4\frac{1}{2}$	$1\frac{3}{4}$	50	$1\frac{1}{2}$	30	$4\frac{1}{4}$	78	—	—	—	—	$\frac{7}{16}$	180
2,000	6	2	65	$1\frac{5}{8}$	41	5	100	—	—	—	—	$\frac{1}{2}$	260
2,500	$7\frac{1}{2}$	$2\frac{1}{4}$	80	$1\frac{3}{4}$	50	6	160	—	—	—	—	$\frac{9}{16}$	300
3,300	10	$2\frac{1}{2}$	100	2	65	$6\frac{1}{2}$	166	—	—	—	—	—	
4,200	$12\frac{1}{2}$	$2\frac{3}{4}$	124	$2\frac{1}{8}$	75	7	200	2 x$\frac{3}{8}$	144	—	—	$\frac{5}{8}$	400
5,000	15	3	145	$2\frac{1}{4}$	80	$7\frac{1}{2}$	234	$2\frac{1}{4}$x$\frac{3}{8}$	154	—	—	$\frac{11}{16}$	460
6,000	18	$3\frac{1}{4}$	158	$2\frac{3}{8}$	97	$7\frac{3}{4}$	250	$2\frac{1}{2}$x$\frac{3}{8}$	171	—	—	—	
7,000	21	$3\frac{1}{2}$	180	$2\frac{1}{2}$	100	$8\frac{1}{4}$	284	3 x$\frac{3}{8}$	220	2 x$\frac{3}{8}$	144	$\frac{3}{4}$	533
8,000	24	$3\frac{3}{4}$	200	3	140	9	333	3 x$\frac{1}{2}$	270	$2\frac{1}{2}$x$\frac{3}{8}$	171	$\frac{13}{16}$	650
9,000	27	4	250	$3\frac{1}{4}$	158	10	433	4 x$\frac{3}{8}$	275	$2\frac{1}{2}$x$\frac{1}{2}$	210	$\frac{7}{8}$	720
10,000	30	$4\frac{1}{4}$	284	$3\frac{1}{2}$	190	$10\frac{1}{2}$	466	4 x$\frac{1}{2}$	345	3 x$\frac{3}{8}$	225	$\frac{15}{16}$	833
11,000	33	$4\frac{1}{2}$	320	$3\frac{5}{8}$	195	11	500	$4\frac{1}{2}$x$\frac{1}{2}$	395			1	933
12,000	36	$4\frac{3}{4}$	350	$3\frac{3}{4}$	200	12	567	5 x$\frac{1}{2}$	425	$3\frac{1}{2}$x$\frac{3}{8}$	242	—	
13,500	40	5	380	$3\frac{7}{8}$	225	13	784	$5\frac{1}{2}$x$\frac{1}{2}$	465	3 x$\frac{1}{2}$	270	$1\frac{1}{16}$	1,000
18,000	55	$5\frac{1}{2}$	440	4	250	14	900	6 x$\frac{1}{2}$	510	4 x$\frac{3}{8}$	275		
22,000	65	6	540	$4\frac{1}{4}$	280	16	1166	$6\frac{1}{2}$x$\frac{1}{2}$	560	5 x$\frac{3}{8}$	356		

NOTE—Drums or Pulleys should be 1000 times the size of the wire with which the rope is made, and in all cases the rope must lead fair into the pulley.

Table showing Size, Weight and Length of Iron Wire (Worcester Gauge).

Gauge Nos.	Diameter Inches.	Area Square inch.	Ultimate Strength in lbs.	Weight of 100 feet. lbs.	Wt. of 1 mile. lbs.	Feet in 63 lbs. Feet.	Feet in 2,000 lbs. Feet.
0000	.393	.121300	9,704	40.94	2163.	154	4,885
000	.362	.102900	8,232	34.73	1834.	181	5,759
00	.331	.086040	6,883	29.04	1533.	217	6,886
0	.323	.081930	6,754	27.66	1460.	228	72,30
1	.283	.062900	5,032	21.23	1121.	296	9,425
2	.263	.054320	4,345	18.34	968.	343	10,905
3	.244	.046759	3,741	15.78	833.	399	12,674
4	.225	.039760	3,181	13.39	707.	470	14,936
5	.207	.033653	2,692	11.35	599.	555	17,621
6	.192	.028952	2,312	9.73	514.	647	20,555
7	.177	.024605	1,968	8.03	439.	759	24,906
8	.162	.020612	1,648	6.96	367.	905	28,734
9	.148	.017203	1,376	5.08	306.	1,086	34,483
10	.135	.014313	1,144	4.83	255.	1,304	41,408
11	.120	.011309	904	3.82	202.	1,649	52,356
12	.105	.008659	693	2.92	154.	2,158	68,493
13	.092	.006647	532	2.24	118.	2,813	89,286
14	.080	.005260	421	1.69	89.	3,728	118,343
15	.072	.004071	328	1.37	72.	4,598	145,985
16	.063	.003117	248	1.05	55.	6,000	190,476
17	.054	.002290	184	.77	41.	8,182	259,740
18	.047	.001734	138	.58	31.	10,862	344,827
19	.041	.001320	105	.45	24.	14,000	444,444
						Ft. in 12 lb	
20	.035	.000963		.32	17.	3,750	625,000
21	.032	.000803		.27	14.	4,444	740,741
22	.028	.000615		.21	11.	5,714	952,381
23	.025	.000491		.17	9.	7,059	1,176,500
24	.023	.000415		.14	7.4	8,571	1,428,580
25	.020	.000314		.11	5.8	10,909	1,818,180
26	.018	.000254		.085	4.5	14,117	2,352,940
27	.017	.000227		.076	4.0	15,790	2,631,580
28	.016	.000201		.067	3.54	17,910	2,986,560
29	.015	.000176		.059	3.11	21,340	3,390,000
30	.014	.000154		.052	2.75	23,080	3,846,150
31	.013	.000133		.045	2.38	26,666	4,444,444
32	.012	.000113		.038	2.00	31,600	5,263,160
33	.011	.000095		.032	1.69	37,500	6,250,000
34	.010	.000078		.026	1.37	46,154	7,692,310
35	.0095	.000071		.024	1.27	50,000	8,333,333
36	.009	.000064		.022	1.16	54,545	9,090,909
37	.0085	.000057		.019	1.03	63,160	10,526,520
38	.008	.000050		.017	.897	70,600	11,764,700
39	.0075	.000044		.015	.792	80,000	13,333,333
40	.00725	.000041		.014	.739	85,715	14,285,710

The strength of the wire in above table is taken at 80,000 lbs. per square inch; and the table of ultimate strength is for hard or bright wire. Annealing or softening reduces the tensile strength about forty per cent.

The Gauge in use in our Wire Mills is the Worcester Gauge.

When great accuracy is required, the *diameter* should be given.

UNIVERSITY OF CALIFORNIA

PRICE LISTS.

TERMS:

All Prices are subject to change without notice.

Persons with whom we have no account will avoid unnecessary correspondence, by accompanying their order with city references or cash.

No orders filled C. O. D. unless accompanied by fifty per cent. of value of order.

Packing and Cartage charged at cost.

All bills not paid when due, will be drawn for at sight.

The utmost expedition and care will be exercised in executing orders with which we may be entrusted, and our customers will confer a favor by immediately drawing our attention to any lack of promptness, care or courtesy.

No cut rope will be received back, it being difficult to dispose of odd lengths.

WIRE.

Nos.....	000 to 2	3 to 9	10 and 11	12	13 and 14	15 and 16	17	18
Cts. per lb..	9	10	11	11½	12½	14	15	16

Bright and Annealed Market Wire	Discount on above List.
Bessemer Steel, (Annealed or Bright) Wire	" " " "
Bright and Annealed Charcoal Wire	" " " "
Annealed Sewing Wire	" " " "
Coppered Market Wire	" " " "
Coppered Pail Bale Wire	" " " "
Galvanized Market Wire.	" " " "
Galvanized Fence Wire	" " " "
Furniture Spring Wire (carbonated)	Net Cash.

Telegraph and Telephone Wire.

Put up in half mile bundles.

Price per lb. net.	6	7	8	9	10	11	12	13	14
Galvanized B. B....	.....	.....	.....	.....	... ..	.....	. ....	.....	.....
Galvanized Ex. B. B.	.....	.....	.....	.....	.....	.....	.....	.....	.....
Black B. B.....	.....	.....	.....	.....	.....	.....	... ..	.....	.....

Galvanized B. B., or Extra B. B., in bond for export.

Annealed Stone or Weaving Wire.

Nos.	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Cts. lb	16	19	20	21	22	23	24	25	26	28	29	30	32	33	35	37	40	45	55

No. 18..... ..... per cent. discount from list.

Nos. 19 to 26 inclusive..... .... " " "

Nos. 27 to 36 inclusive..... .... " " "

Galvanized Stone Wire, 19 to 30..... " " "

Extra Fine Stone Wire.

Nos.	37	38	39	40	41	42	43	44	45	46	47
Cts. per lb.	50	55	60	65	70	75	85	95	1.10	1.25	1.50

Tinned Wire.

Nos.	0 to 9	10 & 11	12 & 14	15 & 16	17	18
Cts. per lb.	15	16	17	17½	18	18½

Tinned Market Wire..... ..... per cent. discount.

Tinned Stone Wire.

Nos.	18	19 & 20	21 & 22	23 & 24	25	26	27	28	29	30	31	32	33	34	35	36
Cts. per lb.	18½	19	20	21	22	23	24	25	26	27	28	32	33	34	40	48

Nos. 18 to 31 inclusive..... per cent. discount from list.

Nos. 32 to 36 inclusive..... " " " "

Extra Fine Tinned Stone Wire.

Nos.	37	38	39	40
Cts. per lb.	70	80	90	1.00

Tinned Broom Wire.

Nos.	18 to 20	21 & 22	23 & 24
Cts. per lb.	20	21	22

per cent. discount.

Crucible Steel Wire.

Nos.	000 to 6	7 to 9	10 & 11	12	13 & 14	15 & 16	17	18
Cts. per lb.	20	21	22	23	24	25	26	28

Nos.	19	20	21	22	23	24	26	28	30
Cts. per lb.	30	35	45	50	55	65	75	90	1.15

SPECIAL KINDS AND FORMS OF WIRE MADE TO ORDER.

Spooled Wire.

Annealed Iron wire, Nos. 24 to 40.....per doz. $2 50
Tinned " " " " ..... " 3 00

per cent. discount.

WIRE STAPLES—Self-Clinching and Pointed.

Sizes, Approximate number in one Pound and Price per Pound.

Size of Wire.	No. 8.		No. 9.			No. 10.				No. 11.		
Length in inches...	2	1¾	2	1¾	1½	2	1¾	1½	1¼	1½	1¼	1
No. to the lb. about.	50	60	60	77	81	82	95	103	120	150	157	185
Price per lb., cts..	10	10	10	10	10	11	11	11	11	11	11	11

Size of Wire.	No. 12.		No. 13.		No. 14.		No. 15.	No. 16.	No. 17.
Length in inches....	1¼	1	1¼	1	1	¾	¾	¾	¾
No. to the lb. about..	200	220	227	292	380	480	675	845	970
Price per lb., cts...	11½	11½	12½	12½	12½	12½	14	14	15

Discount, Galvanized.....per cent.
" Plain.....per cent.

SPECIAL SIZES MADE TO ORDER.

Wire Nails.

Prices per pound.

LENGTHS.	WIRE GAUGE.	8	9	10	11	12	13	14	15	16	17	18	19	20
¾	Cents per lb.					26	28	30	35	35	40	45	45	57
⅞	Cents per lb.					26	28	30	35	35	40	45	45	57
1	Cents per lb					24	26	26	30	33	35	40	43	55
1¼	Cents per lb.				18	22	24	26	30	33	35	37	40	55
1½	Cents per lb.				18	20	22	24	26	30	30	35	40	
1¾	Cents per lb.		17	17	17	18	20	24	26	30	30	35		
2	Cents per lb.	16	16	17	17	18	20	22	25	30	30			

PRICE LIST OF CALIFORNIA WIRE WORKS' WIRE ROPES, PER POUND.

Circumference..	Approximate Diameter.....	Refined Charcoal Hoisting Ropes.		Crucible Cast Steel Hoisting Ropes.		Galvanized Iron Ships' Rigging, Guys, etc.	
		Coarse.	Flexible.	Coarse.	Flexible.	Coarse.	Flexible.
1 in.	$\frac{5}{16}$ in.	32 cts.	.. cts.	48 cts.	.. cts	20 cts	.. cts
$1\frac{1}{4}$	$\frac{3}{8}$	28	..	46	..	20	..
$1\frac{1}{2}$	$\frac{7}{16}$	25	38	36	50	18	26
$1\frac{3}{4}$	$\frac{1}{2}$	23	35	34	45	16	24
2	$\frac{5}{8}$	22	25	32	36	15	22
$2\frac{1}{4}$	$\frac{11}{16}$	21	23	30	32	$13\frac{1}{2}$	20
$2\frac{1}{2}$	$\frac{13}{16}$	20	22	28	32	$12\frac{1}{2}$	20
$2\frac{3}{4}$	$\frac{7}{8}$	19	21	28	30	12	20
3	$\frac{15}{16}$	18	20	28	30	12	16
$3\frac{1}{4}$	$1\frac{1}{16}$	18	20	28	30	$11\frac{1}{2}$	16
$3\frac{1}{2}$	$1\frac{1}{8}$	17	19	26	28	$11\frac{1}{2}$	16
$3\frac{3}{4}$	$1\frac{3}{16}$	17	19	26	28	$11\frac{1}{2}$	16
4	$1\frac{1}{4}$	16	18	26	28	11	16
$4\frac{1}{2}$	$1\frac{7}{16}$	16	18	26	28	11	16
5	$1\frac{5}{8}$	15	17	24	26	11	16
$5\frac{1}{2}$	$1\frac{3}{4}$	15	17	23	25	11	16
6	$1\frac{15}{16}$	15	17	23	25	11	16

Our Ropes, both Flat and Round, are made of the best material, and for strength and durability are superior, and are giving better satisfaction, than those of any other manufacturer.

Coarse Ropes are made 6 strands of 7 wires. Flexible Ropes are made 6 strands, 19 wires; smaller than $1\frac{3}{4}$ inch, 6 strand, 12 wires.

Flat Iron Wire Ropes, ordinary sizes, 25 to 30 cents per pound.

Flat Steel Wire Ropes, ordinary sizes, 35 to 40 cents per pound.

(Sept. 1, 1882.)

Cable laid Ropes, Bridge Cables, etc., prices on application.

Siemen-Martin & Bessemer Steel, same price as charcoal.

Price List of Wire Cords, Strands, Etc.

Cords for Window Sashes, Dumb Waiters, Signal Purposes, Picture Cords, etc

Circumference in inches.....	¼	⅜	½	⅝	¾	⅞	
Price per yard, **Plain Iron**.....	10	13	16	18	20	22	cents.
Price per yard, **Galvanized Iron**.	14	16	18	20	25	30	cents.
Price per yard, **Copper**.....	18	21	23	25	30	35	cents.
Price per yard, **Tinned**.....	13	14	17	19	24	30	cents.

Crucible steel cords, prices on application.

Copper Wire Rope Lightning Conductors.

Diameter in Inches.....	⅜	1/16	½	
Price per foot.....	28	32	37	cts

Flat Wire Rope Thoroughbraces.

For wagons and coaches. These thoroughbraces are but ¼ the weight, 1-5 the size and 5 times as durable as the best leather thoroughbraces:

For.....	1 horse wagon.	2 horse wagon.	4 horse wagon.
Price per pair, iron..	$16 00	$18 00	$20 00
" " " steel..	22 00	24 00	26 00

Seven-ply Wire Strand for Guys, Fencing, Signals, Etc.

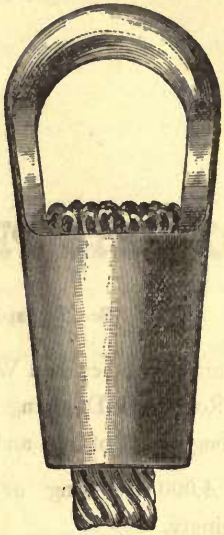
Trade Number.....	00	0	1	2	3	4	5	6	7
Diameter, inches.....	½	7-16	⅜	5-16	¼	¼ sml	1-5	1-6	1-7
Price pr. 100 feet, black	$5.00	4.00	2.80	2.35	1.90	1.40	1.00	.85	.75
Price pr. 100 feet, galvanized...	$5.25	4.30	3.00	2.50	2.00	1.50	1.15	1.00	.80

Galvanized Clothes Line Wire—7 ply.

Trade Number.....	7	7½	8	9
Price per doz. coils of 100 feet each.	$8 00	8 00	7 50	6 75

Vineyard strand for laying out vineyards.....1 ct. per foot.

Galvanized Thimbles and Cones for Wire Rope.



Circumference of Rope...	1¼	1½	1¾	2	2½	3	3½	4
Price of Thimbles, each..	20	20	25	25	25	30	35	40 cts.
Price of Cones, each.....$3	00	3 00	3 00	3 00	3 50	3 50	4 00	4 00

Note.—Thimbles are spliced into the ropes. In the Cone the wire rope is inserted, the wires turned back, the hemp heart removed and a tapering plug driven in, or the space filled with lead or sulphur.

Patent rope clamps, each.....**$1 10.**

Sash Pulleys for Wire Cord.

Diameter of Wheel.	Brass face and wheel.	Iron face and wheel.
1¾	$4 25 per doz.	$1 75 per doz.
2	4 50 " "	2 00 " "

Patent Grip Pulleys.

Diameter, feet ...	3	4	5	6	7	8	9	10
Price, Gold.....	$30	$50	$80	$125	$175	$220	$280	$320

APPROXIMATE PRICES FOR ROPEWAYS.

[See Transportation of Ore, page 26.]

For all material other than Wood or Stone work, but including all Iron-work, Wire Rope, Self-Dumping Ore Buckets, (holding 100 lbs. each,) etc. Measured along center of line, and from back of Grip Pulley.

For a line 4,000 feet long or less, $1.00 per foot and $1,000 for end machinery.

For a line over 4,000 feet and under 6,000 feet, $1.20 per foot, and $1,000 for end machinery.

For a line 6,000 feet to 10,000 feet, $1.40 per foot, and $1,500 for end machinery.

Vertical Angles are extra.

If power is needed this will be extra.

With Angle of Descent=7 degrees (fall of 1 in 8) line will run by gravitation.

Above lines will deliver from 5 to 12 tons per hour with aid of two men.

For Ropeways, a special kind of Wire Rope is manufactured.

Prices of Wire Ropeways, Wire Tramways, Suspension Bridges, Submarine Telegraph Cables, and other manufactures will be given on application.

TELEGRAPH SUPPLIES.

We keep in stock the usual telegraph supplies and can manufacture and furnish anything needed in that line.

Galvanized Telegraph and Telephone Wire.

Sizes: No.	8	9	10	11	12	13	14	15
B. B.....	.....	.....	.....	.....	.....	.....	.....	.....
Extra B. B....	.....	.....	.....	.....	.....	.....	.....	.....

Office Wire.

Red and white braided. Paraffined and compressed cotton and linen double covered office wire, fine finish.

Size: No.	12	14	16	18	$1.00 per lb.
Feet per lb.	35	52	90	132	

Burglar Alarm, Call Bell and Annunciator Wires.

Double cotton wrapped, waxed and paraffined.

Sizes: No.	18	19	20
Feet in 1 lb.	155	200	239
Price per lb.	90 cts.	$1.00	$1.00

Insulators.

Regular pattern ..... $9.00 per 100.
Pony " ..... 6.50 " "

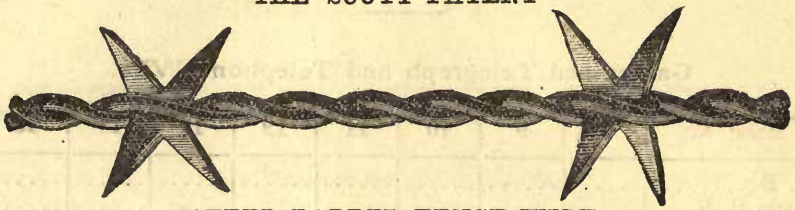
Brackets.

Good Strong Oak..... $7.00 per 100.
" " " painted... ..... 8.00 " "

BARBED FENCE WIRE.

We are the sole licensed manufacturers on the Pacific Coast of the patent Barbed Fence Wire. We manufacture the four pointed all steel cable laid Barbed Fence Wire, as per engraving.

THE SCUTT PATENT



STEEL BARBED FENCE WIRE.

Farmers and Ranchmen will please note that the poorest fence you can use is a brush fence. The next best is a worm fence. A board fence is better still. A WIRE fence is still better. A BARBED WIRE fence is the best, most effective, cheapest and most enduring. The CHEAPEST is the best, and the BEST is manufactured by the CALIFORNIA WIRE WORKS.

Two cable laid wires, combining all the advantages of all barbed wires, with the best four pointed STEEL Barb in the market. Manufactured under license from the holders of the original patents, in our own factory, under our own supervision, employing only the best workmen.

The barbs are six inches apart, and the whole is neatly put up on strong reels holding about 100 lbs. each. Galvanized, or coated with a weather proof Iron Cement,—rust proof. Weighs 17 ounces to the rod. Costs from 40 to 20 per cent. less than a strong board fence. 1440 lbs. will make a fence one mile long and four wires high. Wind and fire have no effect on it. Boys do not disturb it.

It is a strong four-pointed argument which both man and beast will heed. Three wires and one board, with posts eight or ten feet apart, make a hog tight fence.

For horses and cattle a safe and strong fence is made with three wires, with posts from ten to twenty feet apart.

To fence	1	square	section	requires	4	miles	single	Barb	Fence	Wire,	weighs	about 1440 lbs.
"	½	"	"	"	3	"	"	"	"	"	"	" 1080 "
"	¼	"	"	"	2	"	"	"	"	"	"	" 720 "
"	80	acres		"	1½	"	"	"	"	"	"	" 540 "
"	40	"		"	1	"	"	"	"	"	"	" 360 "
"	20	"		"	¾	"	"	"	"	"	"	" 270 "
"	10	"		"	½	"	"	"	"	"	"	" 180 "
"	5	"		"	⅜	"	"	"	"	"	"	" 135 "

The above table will enable you to order what you require.

NEW ILLUSTRATED CATALOGUE

—AND—

PRICE LIST

—OF THE—

California Wire Works

Office and Salesroom, - - 6 California Street, San Francisco.

President:
A. S. HALLIDIE,

Vice-President,
JAMES B. STETSON,

Secretary and Treasurer.
HENRY L. DAVIS.

Directors:

I. LAWRENCE POOL,
JAMES B. STETSON,
W. W. MONTAGUE,
HENRY L. DAVIS.
A. S. HALLIDIE.

Banker:
BANK OF CALIFORNIA.

The above Company has acquired all the works, factories, stock in trade, and business of A. S. Hallidie, The California Wire Works Company, and Robinson & Hallidie, and is prepared to fill orders for Wire Ropes and Cables, Wire of all kinds, Wire Goods, Wire Cloth, Barbed Fence Wire, and for everything manufactured from Wire, with promptness and dispatch.

You are cordially invited to visit our show-rooms, No. 6 California street, where you will find an immense variety of Wire Work, decorative and useful.

ALL THE STREET CARS PASS THE DOOR.

Catalogues sent on application. Estimates given, and careful mechanics sent to put up work.

ALTA PRINTING HOUSE.

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TERMS, Etc.

All bills not paid during the month following the purchase will be drawn for at two days' sight. When a longer time is agreed upon, interest must in all instances be added from date, (or average date) of invoice.

All Prices Subject to the Market Changes, without Notice

In ordering Wire Cloth, please specify accurately the width and length, mesh and size of wire, as we cannot exchange Wire Cloth after it is cut from the roll.

To patrons at a distance requiring work made to order, we urge the importance of sending careful and correct measurements, clearly expressed, and accompanied with drawing or diagram, whenever practicable.

Strangers, and persons not engaged in regular business, must give city reference, or send remittance when ordering.

No goods will be sent by express C. O. D., unless a remittance of not less than 50 per cent. of value is received before shipment.

No goods made to order for strangers until a deposit of 50 per cent. has been made.

Package and cartage will in all instances be charged at cost.

CALIFORNIA WIRE WORKS.

No. 6 California Street, S. F.

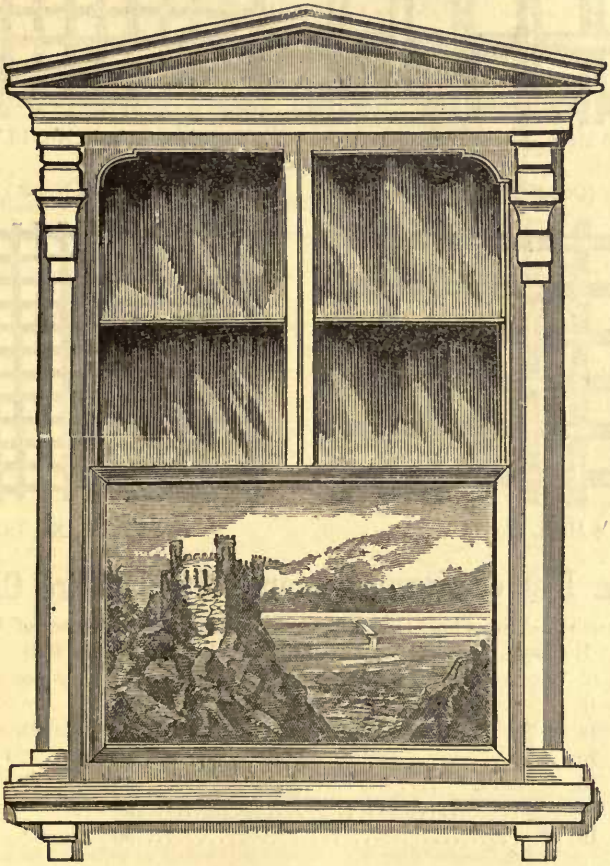
Door, Window and Safe

WIRE CLOTH

Plain-Painted, Figured and Landscape.

An extensive line of all marketable widths, grades and colors.

(Cut No. 1.)



Price List of Window Screen and Safe Cloth.

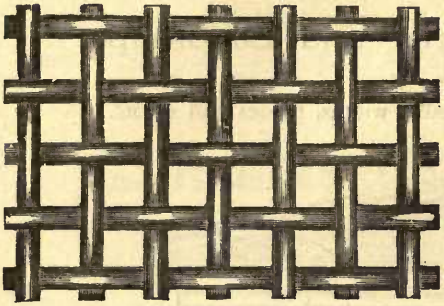
Plain, Green or Drab, by the Roll.....	@	Per Square Foot.
Figured, Black or Green, " "	"	" "
Landscape, Plain, " "	"	" "
" in Colors, " "	"	" "

(No length less than 100 feet is understood to be a Roll.)

WIRE CLOTH.

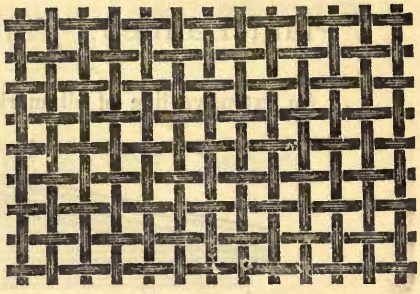
Heavy Crimped for Coal-Burning Locomotives.

(Cut No. 2.)



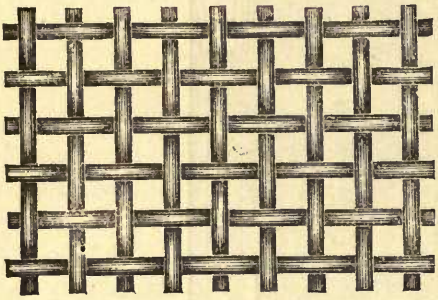
No. 3 Mesh, No. 12 Wire.

(Cut No. 3.)



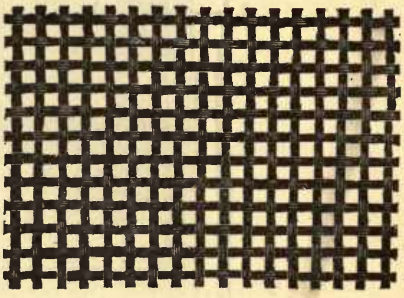
No. 6 Mesh, No. 16 Wire.

(Cut No. 4.)



No. 4 Mesh, No. 14 Wire.

(Cut No. 5.)



No. 8 Mesh, No. 18 Wire.

Price List of Heavy Crimped Spark Wire Cloth.

The mesh in Wire Cloth is the distance from Center to Center of Wires.
No length less than 100 feet shall be understood to be a Roll.

No. 3	Mesh	12	Wire	.....	50	cents	per	square	foot.
" 3½	"	13	"	.....	50	"	"	"	"
" 4	"	14	"	.....	50	"	"	"	"
" 5	"	15	"	.....	50	"	"	"	"
" 6	"	16	"	.....	50	"	"	"	"
" 8	"	18	"	.....	50	"	"	"	"
" 9	"	19	"	.....	50	"	"	"	"

Price List of Heavy Screen Wire Cloth.

The space in Screen Cloth means the space between the wires.
No length less than 100 feet shall be understood to be a Roll.

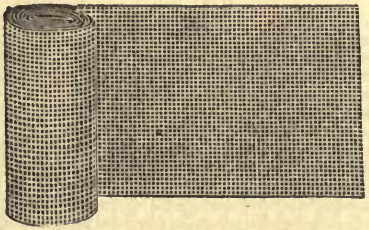
1	inch	space	6	wire	.....	50	cents	per	square foot.
¾	"	"	7	"	.....	50	"	"	" "
⅝	"	"	9	"	.....	50	"	"	" "
½	"	"	10	"	.....	50	"	"	" "
⅜	"	"	11	"	.....	50	"	"	" "

PRICE LIST

—OF—

REGULAR MARKET GRADE IRON WIRE CLOTH.

(Cut No. 6.)



Wire Cloth, Partly Unrolled.

The Mesh in Wire Cloth is the distance from Center to Center of Wires.

No length less than 100 feet shall be understood to be a Roll.

No.	2	Mesh,	made	from	No.	16	Wire	15	cents	per	square	foot.
"	2½	"	"	"	"	17	"	15	"	"	"	"
"	3	"	"	"	"	18	"	15	"	"	"	"
"	4	"	"	"	"	20	"	15	"	"	"	"
"	5	"	"	"	"	21	"	15	"	"	"	"
"	6	"	"	"	"	22	"	15	"	"	"	"
"	7	"	"	"	"	23	"	15	"	"	"	"
"	8	"	"	"	"	24	"	15	"	"	"	"
"	9	"	"	"	"	25	"	15	"	"	"	"
"	10	"	"	"	"	26	"	15	"	"	"	"
"	12	"	"	"	"	27	"	15	"	"	"	"
"	14	"	"	"	"	29	"	15	"	"	"	"
"	16	"	"	"	"	30	"	15	"	"	"	"
"	18	"	"	"	"	32	"	15	"	"	"	"
"	20	"	"	"	"	34	"	15	"	"	"	"

Tinned Wire Cloth.

Any width made to order, not less than 100 feet. For price add 20 per cent. to price of Iron Wire Cloth.

Galvanized Wire Cloth.

Same widths and Meshes as Iron Wire Cloth. For price add 25 per cent. to the price of Iron Wire Cloth.

Galvanized Wire Cloth for Fish Hatching Baskets.

No.	5x ⅜,	for	Salmon	20	cents	per	square	foot.
"	6x ⅜,	for	McCloud River Trout	20	"	"	"	"
"	8x2,	for	Eastern Trout	20	"	"	"	"
"	12x2,	for	White Fish	20	"	"	"	"

WOODBURY'S FISH HATCHING BASKETS MADE TO ORDER.

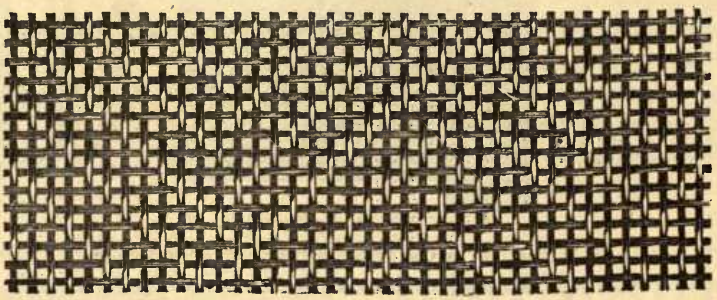
WIRE CLOTH.

The Mesh in Wire Cloth is the distance from Center to Center of Wires.

Twilled Spark Wire Cloth for Wood Burning Locomotive.

No. 10 Mesh Cloth. We make all Meshes from No. 4 to No. 14.

(Cut No. 7.)



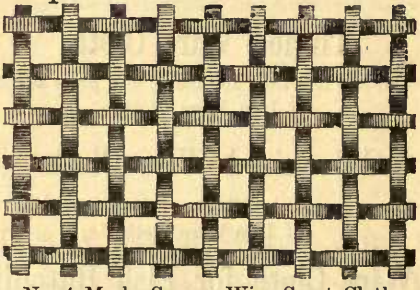
Price List of Twilled Spark Wire Cloth.

No length less than 100 feet shall be understood to be a Roll.

No.	4	Mesh,	16	Wire	30	cents	per	square foot
"	5	"	17	"	30	"	"	"
"	6	"	18	"	30	"	"	"
"	8	"	20	"	30	"	"	"
"	10	"	22	"	30	"	"	"
"	12	"	23	"	30	"	"	"
"	14	"	24	"	30	"	"	"

(Cut No. 8.)

Square Wire Smut Cloth.



No. 4 Mesh, Square Wire Smut Cloth.

Price List of Square Wire Smut Cloth.

No length less than 100 feet shall be understood to be a Roll.

Nos.	4 to 10	Mesh,	Extra Stout	$ .75	per square foot.
"	4 to 10	"	Steel Wire Stout	1.25	" " "

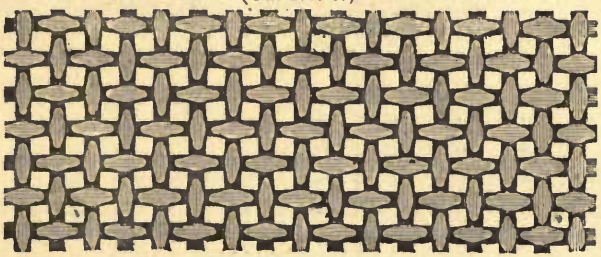
WIRE CLOTH.

The Mesh in Wire Cloth is the distance from Center to Center of Wires.

No length less than 100 feet shall be understood to be a Roll.

Heavy Rolled Wire Cloth for Malt Kiln Floors.

(Cut No. 9.)



This Floor secures *four times more hole space* per square foot than punched sheet iron; allows an unrestricted passage of hot air through the grain, and saves *half the fuel* and much time in the manufacture of Malt.

No. 6 Mesh, of No. 14 Wire.....90 cents per square foot.

Samples furnished on application.

Price List of Extra Heavy Machinery Grade Iron Wire Cloth

No length less than 100 feet shall be understood to be a Roll.

No.	2	Mesh,	made	from	No.	14	Wire	30	cents	per	square	foot.
"	3	"	"	"	"	15	"	30	"	"	"	
"	4	"	"	"	"	16	"	30	"	"	"	
"	6	"	"	"	"	18	"	30	"	"	"	
"	8	"	"	"	"	20	"	30	"	"	"	
"	10	"	"	"	"	22	"	30	"	"	"	
"	12	"	"	"	"	23	"	30	"	"	"	
"	14	"	"	"	"	24	"	30	"	"	"	
"	16	"	"	"	"	25	"	30	"	"	"	
"	18	"	"	"	"	27	"	30	"	"	"	
"	20	"	"	"	"	29	"	30	"	"	"	

Price List of Stout Rice Wire Cloth.

No length less than 100 feet shall be understood to be a Roll.

No.	8	Mesh,	made	from	No.	20	Wire	30	cents	per	square	foot.
"	10	"	"	"	"	22	"	30	"	"	"	
"	12	"	"	"	"	23	"	30	"	"	"	
"	14	"	"	"	"	24	"	30	"	"	"	
"	16	"	"	"	"	25	"	30	"	"	"	

WIRE CLOTH.

The Mesh in Wire Cloth is the distance from Center to Center of Wires.

Price List of Light Grade Iron Wire Cloth.

No length less than 100 feet shall be understood to be a Roll.

No.	2	Mesh,	made	from	No.	18	Wire	.....	10	cents per square foot.
"	2½	"	"	"	"	19	"	.....	10	" " "
"	3	"	"	"	"	20	"	.....	10	" " "
"	4	"	"	"	"	22	"	.....	10	" " "
"	5	"	"	"	"	23	"	.....	10	" " "
"	6	"	"	"	"	24	"	.....	10	" " "
"	8	"	"	"	"	26	"	.....	10	" " "
"	10	"	"	"	"	28	"	.....	10	" " "
"	12	"	"	"	"	29	"	.....	10	" " "
"	14	"	"	"	"	33	"	.....	10	" " "
"	16	"	"	"	"	34	"	.....	10	" " "
"	18	"	"	"	"	35	"	.....	10	" " "
"	20	"	"	"	"	36	"	.....	10	" " "

Any width made to order at short notice.

CHESS CLOTH

—OR—

Long Mesh Wire Cloth.

FOR GRAIN SCREENS.

Mesh	1 x 4	.....	15	cents	per square foot.
"	¾ x 5	.....	15	"	" "
"	2 x 6	.....	15	"	" "
"	2 x 7	.....	15	"	" "
"	2 x 8	.....	15	"	" "
"	2 x 9	.....	15	"	" "
"	2 x 10	.....	15	"	" "
"	2 x 11	.....	15	"	" "
"	2 x 12	.....	15	"	" "
"	3 x 9	.....	15	"	" "
"	3 x 10	.....	15	"	" "
"	3 x 11	.....	15	"	" "
"	3 x 12	.....	15	"	" "
"	4 x 12	.....	15	"	" "
"	4 x 14	.....	15	"	" "
"	4 x 16	.....	15	"	" "

CHESS CLOTH *extra heavy*, 20 cents per square foot.

Price List of Heavy Steel Tempered Wire

Battery and Bolting Cloth

No length less than 100 feet shall be understood to be a Roll.

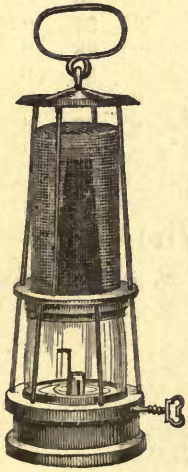
No. 24	Mesh,	made	from	No. 27	Wire	(Blued)	.....	55	cents per square foot.
" 30	"	"	"	29	"		.....	56	" "
" 35	"	"	"	31	"		.....	57	" "
" 40	"	"	"	32	"		.....	58	" "
" 50	"	"	"	35	"		.....	59	" "
" 60	"	"	"	36	"		.....	68	" "
" 64	"	"	"	37	"		.....	75	" "
" 70	"	"	"	38	"		.....	80	" "
" 74	"	"	"	39	"		.....	90	" "
" 80	"	"	"	40	"		.....	1.05	" "

This grade of Cloth is wove and kept in stock, 18 and 24 inches wide.

The increasing demand for HEAVY BATTERY AND BOLTING CLOTH has induced us to turn our attention more particularly to this branch of the business, and we feel confident in saying, we *can* and *do* produce an article superior to any ever before manufactured in this country. It is made of *a large wire* and *driven up square*, which, on an average, makes it equal to *ten meshes finer per square inch.*

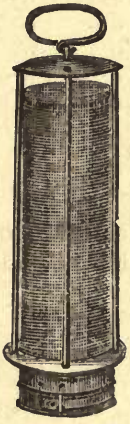
MINERS' SAFETY LAMPS.

(Cut No. 10.)



No. 1.
Sir Humphrey Davy's Improved.

(Cut No. 11.)



No. 2.

Price of Miners' Safety Lamps.

No. 1, Brass Mounted, as per cut	.....	$72.00	per dozen.
" 2, Galvanized Iron	.....	21.00	" "
Extra Guards for same	.....	7.50	" "

PRICE LIST

— OF —

REGULAR MARKET GRADE OF BRASS WIRE CLOTH.

No length less than 100 feet shall be understood to be a Roll.

The Mesh in Wire Cloth is the distance from Center to Center of Wires.

												per sq. foot.
No.	2	Mesh	Brass	Wire	Cloth,	made	from	No.	16	Wire,	50	cents.
"	3	"	"	"	"	"	"	"	17	"	50	"
"	4	"	"	"	"	"	"	"	18	"	50	"
"	5	"	"	"	"	"	"	"	19	"	50	"
"	6	"	"	"	"	"	"	"	20	"	50	"
"	8	"	"	"	"	"	"	"	22	"	50	"
"	10	"	"	"	"	"	"	"	23	"	50	"
"	12	"	"	"	"	"	"	"	24	"	50	"
"	14	"	"	"	"	"	"	"	25	"	50	"
"	16	"	"	"	"	"	"	"	26	"	50	"
"	18	"	"	"	"	"	"	"	27	"	50	"
"	20	"	"	"	"	"	"	"	28	"	50	"
"	22	"	"	"	"	"	"	"	29	"	50	"
"	24	"	"	"	"	"	"	"	30	"	50	"
"	30	"	"	"	"	"	"	"	31	"	52	"
"	40	"	"	"	"	"	"	"	33	"	55	"
"	50	"	"	"	"	"	"	"	35	"	58	"
"	60	"	"	"	"	"	"	"	36	"	60	"
"	70	"	"	"	"	"	"	"	37	"	70	"
"	80	"	"	"	"	"	"	"	38	"	90	"
"	90	"	"	"	"	"	"	"	39	"	1 10	"
"	100	"	"	"	"	"	"	"	40	"	1 30	"
"	120	"	"	"	"	"	"	"	42	"	1 75	"
"	150	"	"	"	"	"	"	"	43	"	3 00	"

Brass Milk Strainer Wire Cloth.

By the quantity, (1000 square feet and over) 20 cts. per square foot, *Net Cash.*
In less quantity at an order.....25 " " " "

Sieve Cloth.

BRASS WIRE SIEVE CLOTH.

No. 20 Mesh, 26 inches wide.....25 cents per square foot.
" 24 " " " " .....27 " " " "

TIN PLATED SIEVE CLOTH.

No. 18 Mesh, 26 inches wide.....12 cents per square foot.
" 20 " " " " .....13 " " " "
" 24 " " " " .....15 " " " "

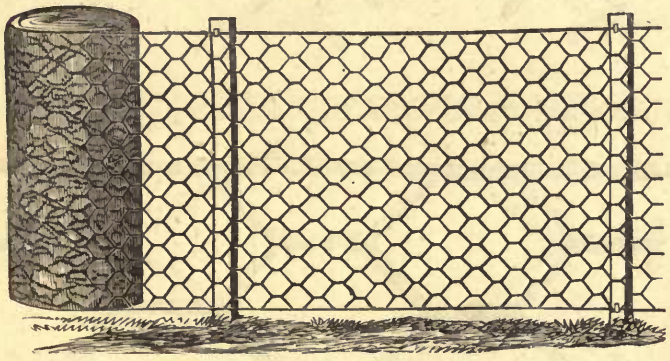
GALVANIZED

Twist Wire-Netting

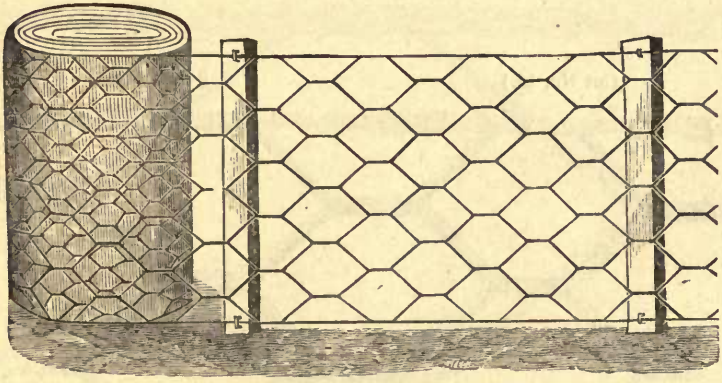
FOR

FARM, GARDEN AND DIVISION FENCES.

No. 1.
(Cut No. 12.)



No. 2.
(Cut No. 13.)

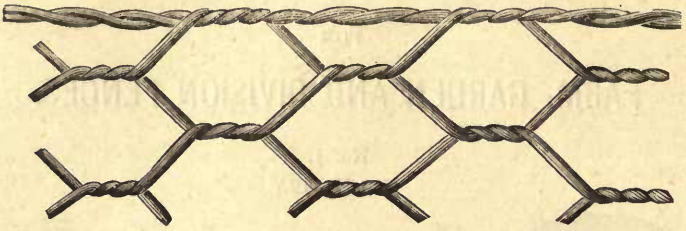


Prices of Galvanized Twist Iron Wire Netting for Fencing.

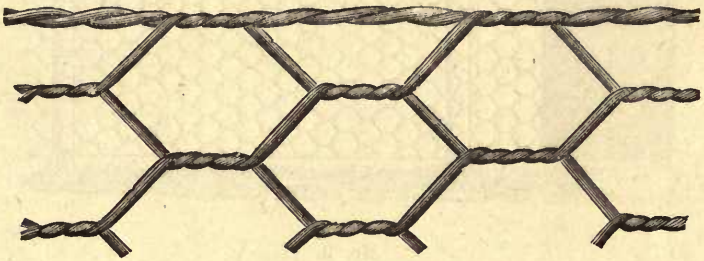
No. 1 is put up in bales of..... .....100 yards each
No. 2 is put up in bales of ... .100 yards each
No. 1, 2-inch Mesh, 4 feet wide, No. 16 wire..... 75 cents per yard
No. 2, 4-inch Mesh, 4 feet wide, No. 16 wire..... .....50 cents per yard

Galvanized Twist Wire Netting.—Continued.

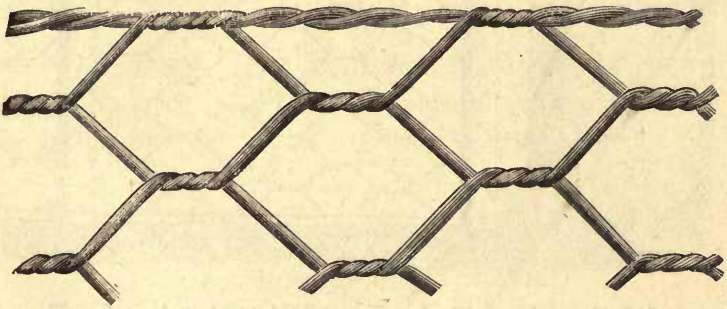
(Cut No. 14.) ½-inch Mesh.



(Cut No. 15.) ⅝-inch Mesh.



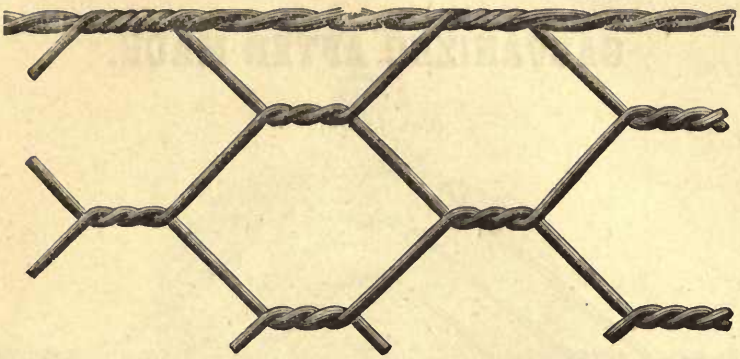
(Cut No. 16.) ¾-inch Mesh.



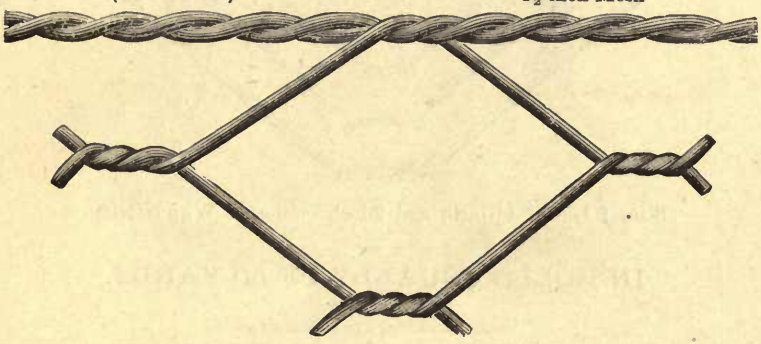
For Prices of above see page 16.

Galvanized Twist Wire Netting.—Continued.

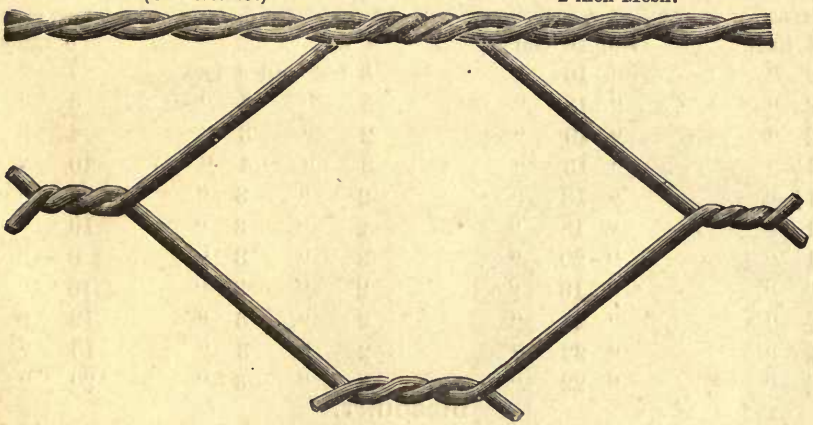
(Cut No. 17.) 1-inch Mesh.



(Cut No. 18.) 1½-inch Mesh



(Cut No. 19.) 2-inch Mesh.



The foregoing Cuts show the different meshes of Galvanized Netting which is used principally for Garden or Ornamental purposes, such as Fencing, Bird Cages, Chicken Coops, etc., where strength, economy and beauty are desired.

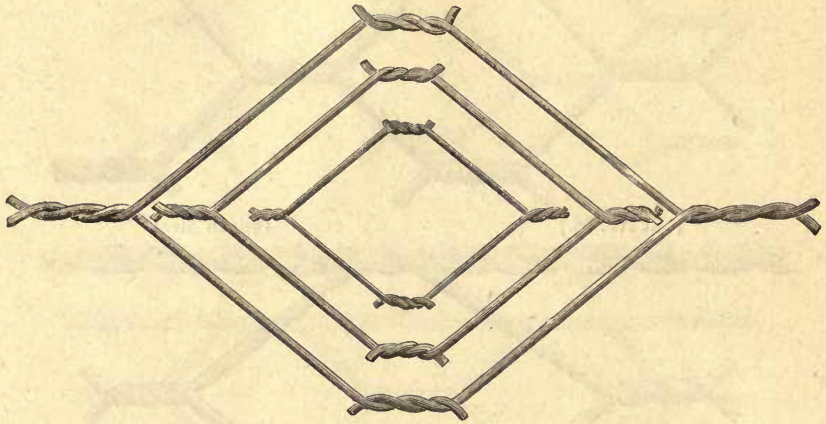
For Chicken Yards this Netting is indispensable, being cheap, light and durable and does not harbor vermin like lattice work. It is thoroughly galvanized after made which protects it from the action of the weather.

For Prices of above see page 16.

WIRE NETTING

GALVANIZED AFTER MADE.

(Cut No. 20.)



Size of 1-inch, 1½-inch, and 2-inch meshes of Wire Netting.

IN ROLLS USUALLY OF 50 YARDS.

Mesh.	Size Wire made from.	Width usually on hand.	Price per sq. ft.
4 inch.	No. 16 Gauge.	4 feet	5 cents.
2 "	" 16 "	3 feet and 4 feet.	7 "
2 "	" 18 "	3 " 4 "	5 "
2 "	" 19 "	2 " 3 "	4 "
1½ "	" 16 "	3 " 4 "	10 "
1½ "	" 18 "	2 " 3 "	6 "
1 "	" 18 "	2 " 3 "	10 "
1 "	" 20 "	2 " 3 "	8 "
¾ "	" 18 "	2 " 3 "	16 "
¾ "	" 20 "	2 " 3 "	12 "
⅝ "	" 22 "	2 " 3 "	15 "
½ "	" 22 "	2 " 3 "	20 "

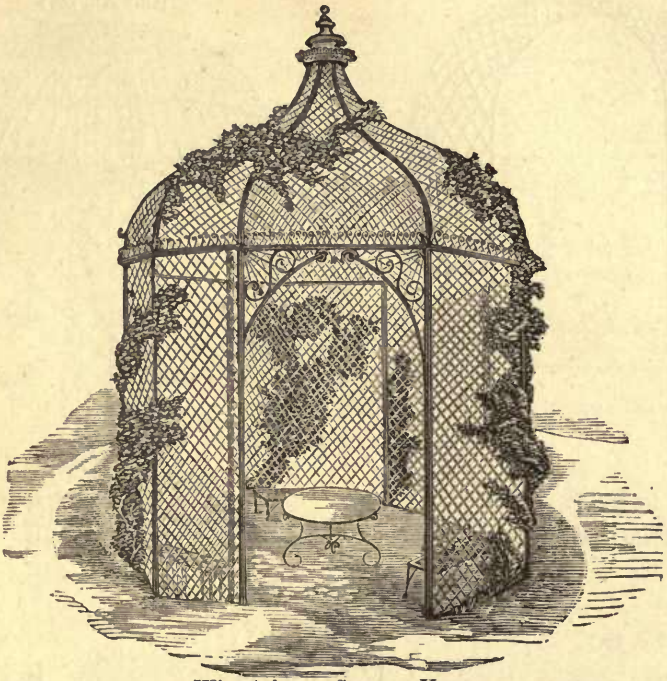
DISCOUNT.

Fence Staples.

Galvanized Wire Staples.....15 cents per pound.

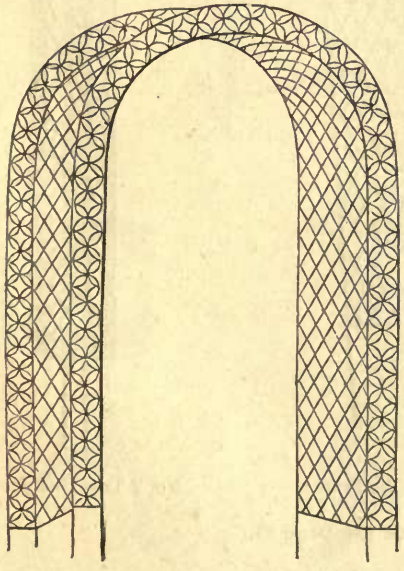
GARDEN, LAWN AND OTHER WIRE WORK.

(Cut No. 21.)



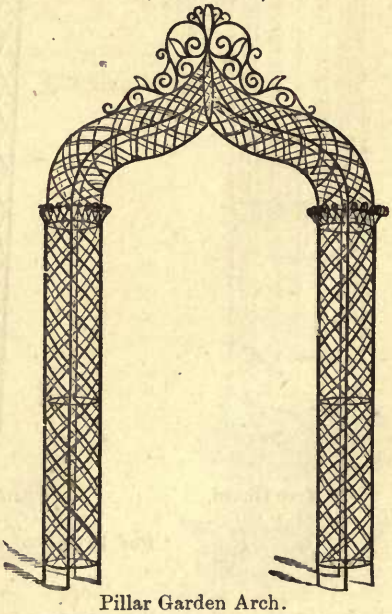
Wire Arbor or Summer House.
All sizes. Made in Sections, and strongly bolted together.

(Cut No. 22.)



Border Garden Arch.
4 feet span, 9 feet high, 3 feet deep.

(Cut No. 23.)

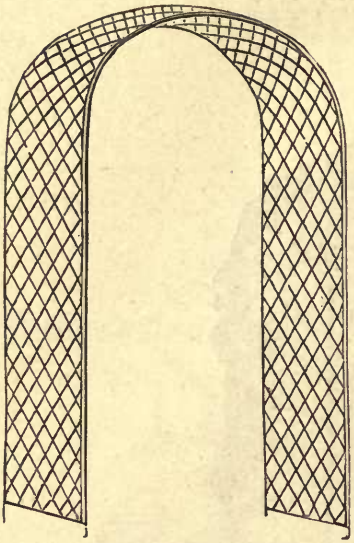


Pillar Garden Arch.
5 feet span, 9 feet high, 12 inches deep.

For Prices of above see page 21.

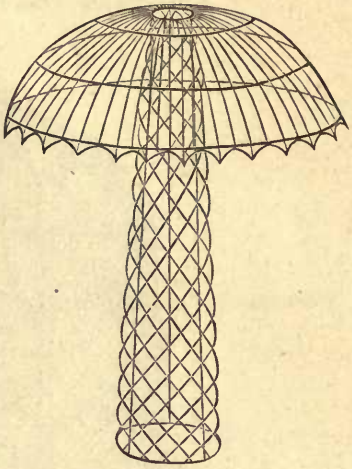
Garden, Lawn and other Wire Work.

(Cut No. 24.)



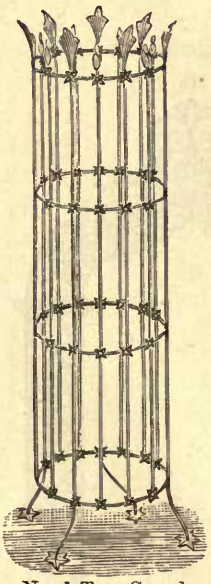
Plain Garden Arch.

(Cut No. 25.)



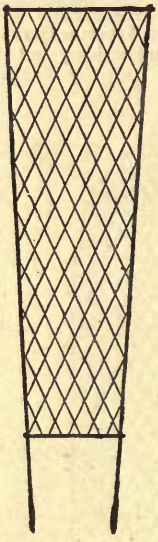
Umbrella Vine Trainer.
4 feet 6 inches high, top 3 feet
6 inches in diameter.

(Cut No. 26.)



No. 1 Tree Guard.

(Cut No. 27.)



Plain Trellis Frame.

(Cut No. 28.)

No. 2 Tree Guard.

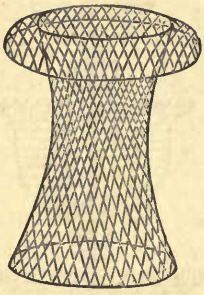
For Prices of above see page 21.

Garden, Lawn and other Wire Work.

(Cut No. 29.)

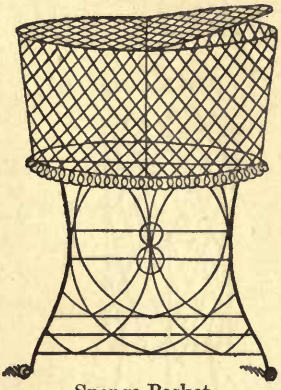
Wire Chair.

(Cut No. 30.)



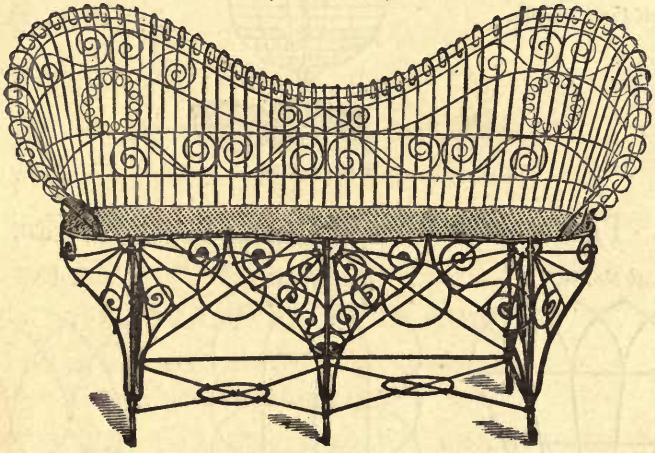
Garden Stool.

(Cut No. 31.)



Sponge Basket.

(Cut No. 32.)

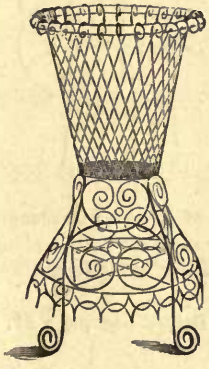


Wire Settee.

(Cut No. 33.)

Fruit or Pitcher Stand.

(Cut No. 34.)



Waste Paper or Work Basket.

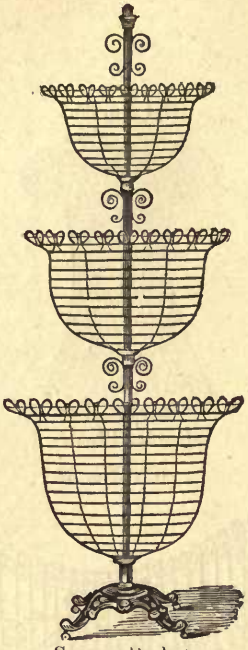
(Cut No. 35.)

Fruit & Flower Stand.

For Prices of above see pages 21 and 22.

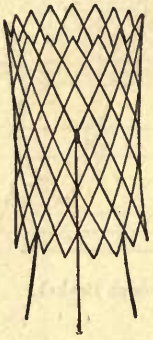
Garden, Lawn and other Wire Work.

(Cut No. 37.)



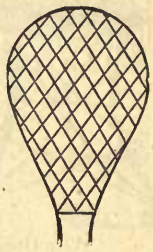
Sponge Basket.

(Cut No. 36.)



Extension Pink Frames.

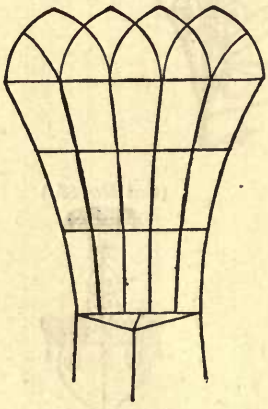
(Cut No. 38.)



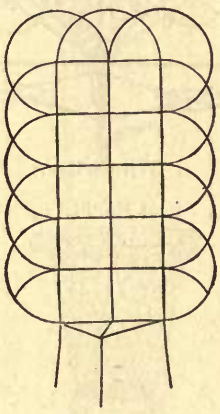
Plain Rose Trainers.

Flower and Vine Trainers, Trellises, Etc.

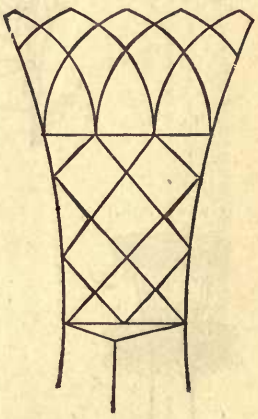
(Cut No. 39.)



(Cut No. 40.)



(Cut No. 41.)



We invite the special attention of Florists, Gardeners and others, to this class of our manufactures, as being vastly superior to the clumsy and perishable wood-work used for similar purposes. Our Trainers, etc., are made of heavy galvanized wire, and are proof to all weather action.

For Prices see page 22.

PRICE LIST

—OF—

Garden, Lawn and other Wire Work.

For Illustrations see pages 17, 18, 19 and 20.

SUMMER HOUSES, BOWERS, FLOWER TEMPLES, Etc.

As per cut 21, Octagon Design, of Diamond Work, 8 feet diameter, 12 feet high, with Settee, Center Table and Chairs..... $ 250 00
The same without furniture..... 200 00

Made in sections convenient for shipping, putting up, etc. Prices according to size and design, from $50 upwards.

BORDERED GARDEN ARCHES.

9 feet high, 5 feet span, 3 feet deep. (Cut No. 22.)..... 25 00

PILLAR GARDEN ARCHES.

9 feet high, 5 feet span, 12 inches deep. (Cut No. 23.)..... 20 00

PLAIN GARDEN ARCHES.

Any dimensions, (Cut No. 24.) 20 cents per square foot.

UMBRELLA VINE TRAINERS.

4 feet 6 inches high, top 3 feet, 6 inches diameter. (Cut No. 25.).. 6 50

GALVANIZED TREE GUARDS.

No. 1—5 feet high, 16 inches diameter. (Cut No. 26.)..... 9 00
No. 2—4 feet 3 inches high, 10 inches diameter. (Cut No. 28.).... 6 00

PLAIN DIAMOND WORK TRELLISES.

Of any length, width and shape required, 20 cents per square foot. (Cut No. 27.)

For fancy styles, extra heavy, etc., prices vary from 25 to 50 cents per square foot.

Long pieces may be rolled up for convenience of shipping, when made of light wire.

WIRE GARDEN CHAIRS.

Various styles in stock. (Cut No. 29.) Each..... 5 00

GARDEN STOOLS.

As per Cut No. 30. Per dozen..... 24 00

Garden, Lawn and other Wire Work.

WIRE SETTEES.

5 feet long, 2 sittings. (Cut No. 32.) Each..... 21 50
Other designs and sizes on hand and made to order.

FRUIT OR PITCHER STANDS.

Japanned and Bronzed. (Cut No. 33.) Each..... 7 00
Painted and Bronzed. (Cut No. 33.) Each..... 6 50

WASTE PAPER OR WORK BASKETS.

Japanned and Bronzed. (Cut No. 34.) Each..... 7 00
Painted and Bronzed. (Cut No. 34.) Each..... 6 50

FRUIT, FLOWER AND CONFECTION STANDS.

For Show Windows, Banquets, Refreshment Tables, Etc. Of tinned wire, 27 inches high. (Cut No. 35.) Each..... 6 50

EXTENSION PINK FRAMES.

No. 1—20 inches high. (Cut No. 36.) Per dozen..... 5 00
No. 2—18 inches high. (Cut No. 36.) " 4 50

These are made of Galvanized Wire, and are admirably adapted for confining and training groups of Pinks and other flowers. They will expand from 5 inch to 20 inch diameter.

SPONGE BASKETS.

Of Laced Wire Work, with three vase-shaped compartments, separately movable on center, 4 feet 3 inches high. (Cut No. 37.) Each..... 12 00

Of Diamond Wire Work, oval, with two compartments, 42 inches high, 32 inches long, 20 inches wide. (Cut No. 31.) Each... 10 00

ROSE AND VINE TRAINERS.

(Cuts No. 38, 39, 40 and 41.)

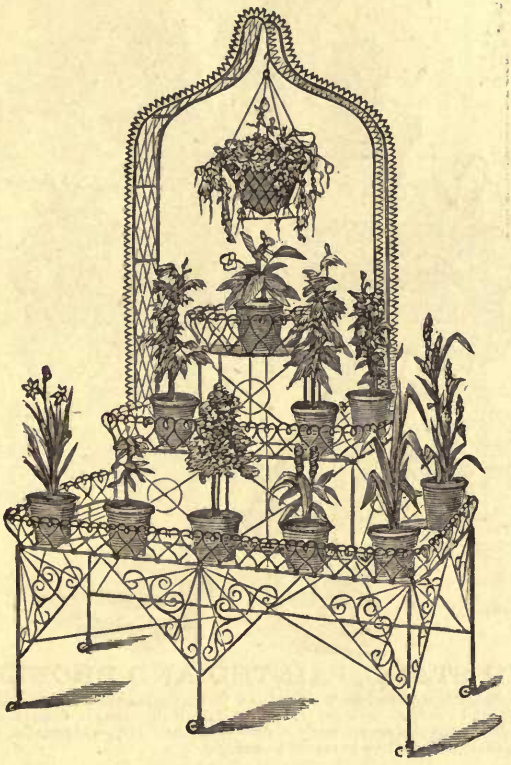
Rose Trainers, Various Styles, 15 Inches High, Per Dozen..... 4 50
" " 20 " " 5 50
" " 24 " " 7 00
" " 30 " " 10 00
" " 36 " " 15 00
" " 42 " " 21 00
" " 48 " " 33 00

Florists and the Trade supplied on liberal terms.

UNIVERSITY OF CALIFORNIA

FLOWER POT STANDS.

(Cut No. 42.)



FLOWER POT STAND, $15.50.

Stand and Arch, 6 feet high; Stand, without arch, 3 feet 4 inches high; depth, 30 inches; length, 3 feet 10 inches. When filled with Flower Pots, this is one of the most attractive parlor ornaments you can get. It is handsomely painted and bronzed, and very ornamental.

N. B.—Galvanized Pans for any of the Flower Pot Stands furnished at a small additional cost.

Flower Pot Stands.—Continued.

(Cut No. 43.)

REVOLVING STAND, PAINTED AND BRONZED, $20.00.

This elegant and most convenient Flower Stand is 4 feet 6 inches high, and 42 inches diameter. It is mounted on an ornamental pedestal, with swivel castors, by which means it is easily and safely moved in any direction. In addition, the shelves are made to revolve on the centre, whereby the plants may have the advantage of frequent change of position in regard to sunlight.

(Cut No. 44.)

BALCONETTES, OR FLOWER POT WINDOW STANDS.

Prices according to size, etc.

2 feet 9 inches long, 4½ inches high, 6 inches wide..... $3 00
3 feet long, 4½ inches high, 7 inches wide..... 3 50
3 feet 4 inches long, 4½ inches high, 7 inches wide..... 4 00

These Balconettes are a delight to all lovers of flowers, and enable the tasteful to convert any sunny window into a small conservatory at trifling cost. They are strongly made, handsome and secure, and are readily attached to inside or outside of windows. Outside they are an efficient guard for flower pots in the highest winds. Made with Galvanized Pans to catch waste water; also with arch, or side trellises for vines, at small extra cost.

Flower Pot Stands—Continued.

(Cut No. 45.)

3-Shelf Upright Stand.

With Arch.....$16 00

Total height, 7 feet; lower shelf 40 inches long, 16 inches wide.

A fine and spacious stand, with high shelves, allowing the plants abundance of sun and room.

Galvanized Pans, to catch any seepage water, are made for the shelves when required, at a small additional cost.

(Cut No. 46.)

3-Step Flower Stand.

With Arch.....$15 00

Total height, 5 feet 9 inches. Depth, 2 feet 5 inches. Length of Shelves, 3 feet 2 inches.

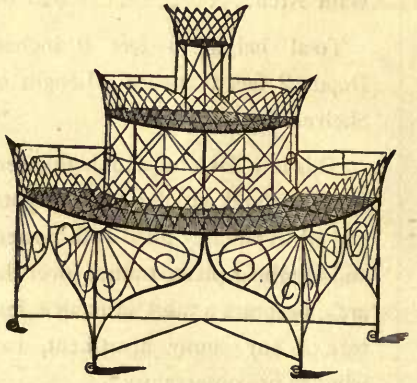
This is a favorite and highly serviceable stand, holding 25 to 30 pots, and when suitably filled with flowers and climbing plants trained over the arch, becomes a most attractive feature of any sunny apartment, bay window or conservatory.

Flower Pot Stands, Etc.—Continued.

(Cut No. 47.)

FLOWER POT STAND, $10.00.

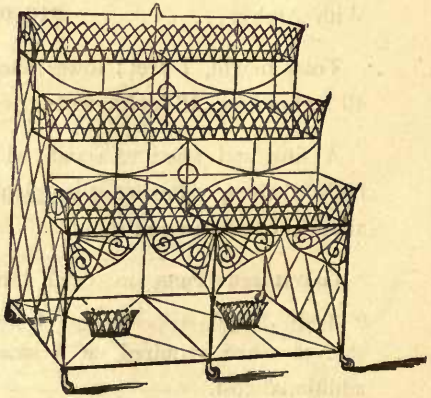
(Cut No. 48.)



Semi-Circular Stand.

42 inch.....$11 00 each
With Galvanized Pans..... 14 00 "

(Cut No. 49.)



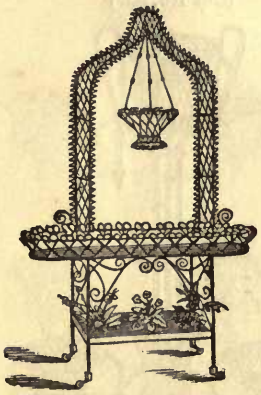
Square 3-step Stand.

36 inch.....$12 00 each
With Galvanized Pans ..... 14 00 "

3-step Triangular Stands, of similar designs, $8.00, $9.00 and $10.00 each.

Flower Pot Stands—Continued.

(Cut No. 50.)

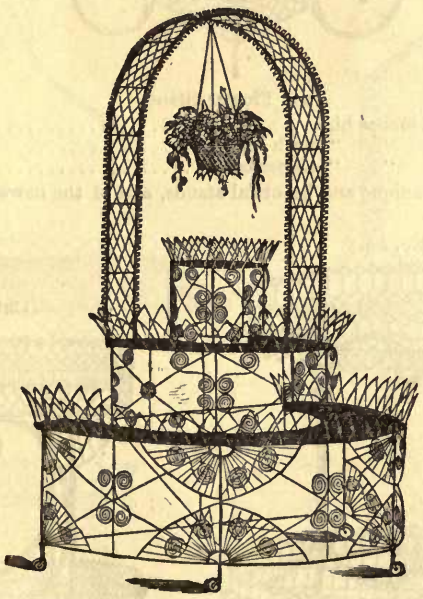


2-Shelf Stand with Arch, $9.50.

(Including Pans.)

Stand and arch 5 feet 6 inches high; shelf, 30 inches long and 12 inches wide. A water-tight pan is fitted in at the base for earth, moss and flowers.

(Cut No. 51.)



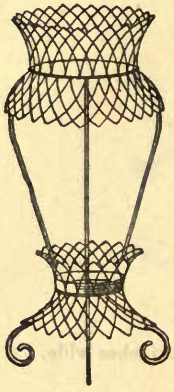
Large Semi-Circular Stand with Arch, painted and bronzed, $17.50

Total height, 6 feet 6 inches; without arch, 3 feet 6 inches; width, 4 feet; depth 3 feet; top shelf; 15 inches diameter.

The above is an extra large stand, capable of holding a large number of pots, and is particularly suitable for spacious bay windows, sunny alcoves, and conservatories. Made larger or smaller than dimensions given, if required.

Flower Pot Stands—Continued.

(Cut No. 52.)

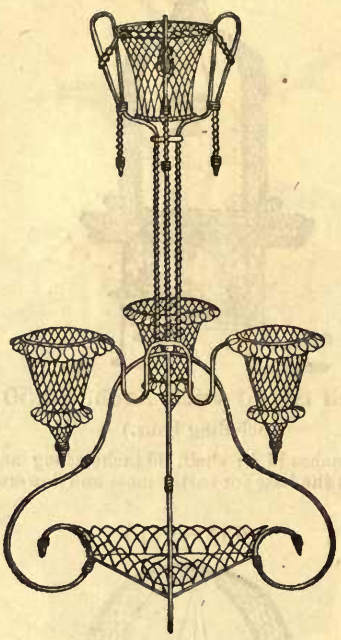


Small Circular Stand.

32 inches high.

$3.00 each.

(Cut No. 53.)

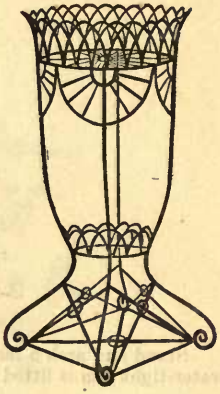


Vase Flower Stand.

With Single Vase, 38 inches high	$3 50
" " " 42 " " with base	5 00
" 4 " 42 " " as per cut	7 50

These are unique and beautiful stands, and of the newest designs.

(Cut No. 54.)

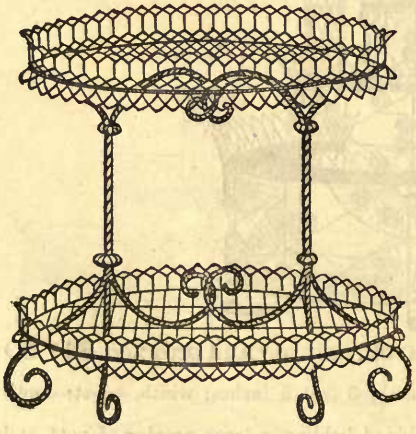


Single Flower Pot Stand.

32 inches high.

$3.00 each.

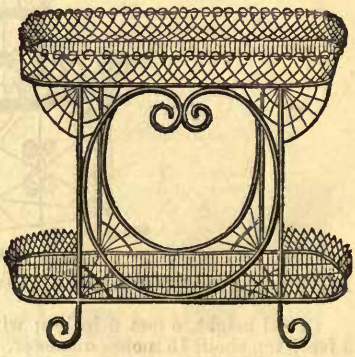
(Cut No. 55.)



2-Shelf Oval Stand.

With Galvanized Pans, 36 in. high	$15 00
With 3-branch Standard	20 00

(Cut No. 56.)



2-Shelf Oblong Stand.

36 inch	$10 00
42 inch	11 00

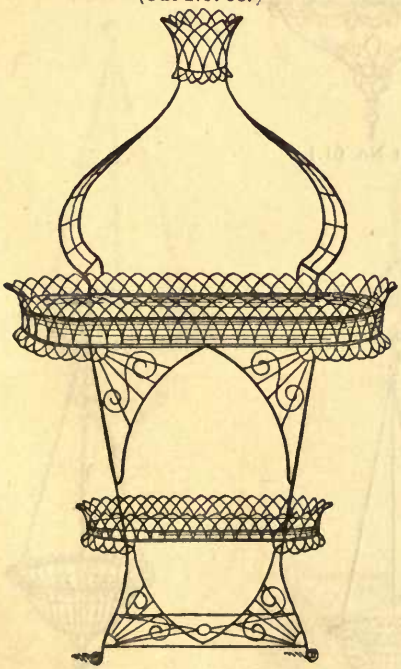
Flower Pot Stands—Continued.

(Cut No. 57.)

Branch Flower Stand.

With 7 Branches, 3 feet 9 inches high.....$15 50

(Cut No. 58.)

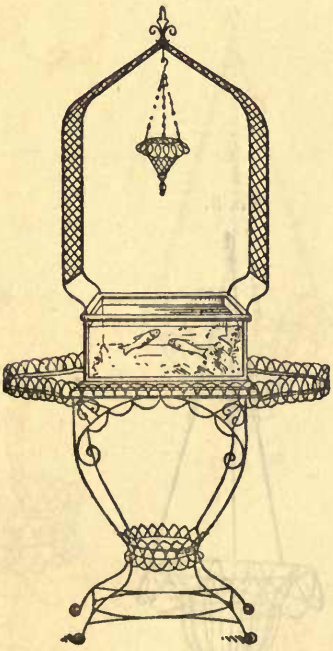


Oblong Stand and Fernery.

With Arch $10 50

Total height, 5 feet; length, 30 inches; depth, 8 inches. These are made with a deep galvanized earth pan, and are especially adapted for mosses, ferns, fine grasses, etc.

(Cut No. 59.)



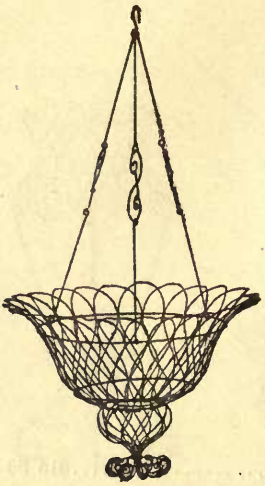
Aquarium Flower Stand.

With Arch.....$12 00

Total height, 5 feet 4 inches; length, 30 inches; depth, 12 inches. An elegant novelty, combining Aquarium and Flower Stand.

Moss and Flower Baskets

No. 1.

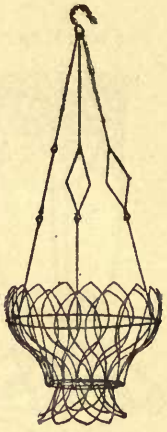


(Cut No. 60.)

No. 5.

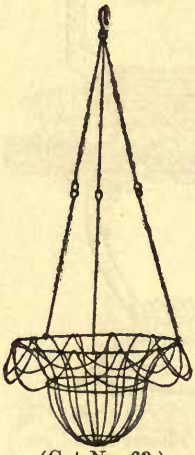
(Cut No. 61.)

No. 2.



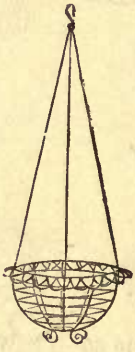
(Cut No. 62.)

No. 3.



(Cut No. 63.)

No. 4.



(Cut No. 64.)

No. 6

(Cut No. 65.)

For Prices of above see page 32.

Moss and Flower Baskets.

No. 7.

(Cut No. 66.)

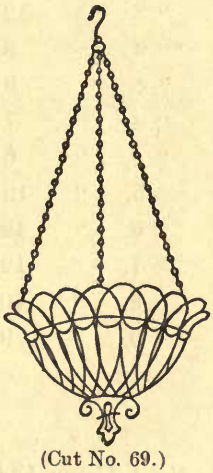
No. 8.

(Cut No. 67.)

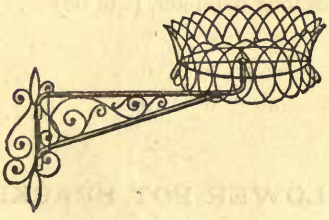
(Cut No. 68.)

Gypsy.

No. 9.



(Cut No. 69.)



(Cut No. 70.)

Flower Pot Bracket.

For Prices of the above, see page 32.

PRICE LIST.

—OF—

Pendant Moss and Flower Baskets

POT BRACKETS, ETC.

See Cuts, Pages 30 and 31.

No. 1,	Basket,	16	inches	diameter,	7	inches	deep,	(Cut 60)...	$14 50 per doz.
" 2,	"	10	"	"	6	"	"	(Cut 62)...	8 50 "
" 3,	"	12	"	"	6½	"	"	(Cut 63)...	7 50 "
" 4,	"	9	"	"	5	"	"	(Cut 64)...	2 75 "
" 4,	"	8	"	"	4¼	"	"	(Cut 64)...	2 25 "
" 4,	"	7	"	"	4	"	"	(Cut 64)...	2 00 "
" 4,	"	6	"	"	3½	"	"	(Cut 64)...	1 75 "
" 5,	"	12	"	"	(Fancy)			(Cut 61)...	42 50 "
" 6,	"	12	"	"	(Scroll Border)			(Cut 65)...	9 50 "
" 7,	"	12	"	"	(Fancy)			(Cut 66)...	10 50 "
" 8,	"	10	"	"	"			(Cut 67)...	10 50 "
" 9,	"	9	"	"	"			(Cut 69)...	7 50 "

GIPSY BASKETS.

No. 1,	Gypsy,	13	inches	long	diameter,			(Cut 68).....	11 50 "
" 2,	"	11	"	"	"	"	"	.....	8 00 "
" 3,	"	8	"	"	"	"	"	.....	5 00 "
" 4,	"	7	"	"	"	"	"	.....	3 50 "

FLOWER POT BRACKETS.

Single,	6	inches	diameter,	(Cut 70).....	8 50 "
Double,	"	"	"	.....	15 00 "

FLORAL DESIGNS.

GARDEN WIRE WORK, ETC.

(Illustrations, pages Nos. 17 to 34.)

Floral Designs of Every Description in Stock and Made to Order, at the Lowest Rates.

Wire Devices, Letters, Emblems, Etc.,
Pot Brackets, Moss Brackets,
Trainers, Pink Frames and Trellises,
Flower Stands, Tree Guards, Arches,
Wire Arbors and Rose Temples,
Fountain, Flower Bed and Path Borders,
Out-Door Furniture, Chairs, Settees, Etc.

Florists, Nurserymen, Gardeners, and others are cordially invited to examine our goods and terms.

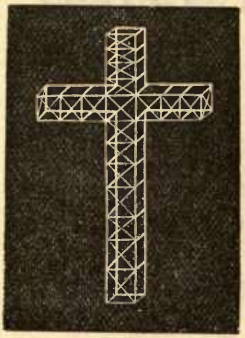
Novelties and unique pieces for special occasions designed and made with the utmost dispatch.

WIRE CROSSES.

(Cut No. 71.)

24 inches high, each	$1 25	36 inches high, each	$2 50
30 " " "	2 00	48 " " "	4 00

DESIGNS FOR FLORAL WORK.



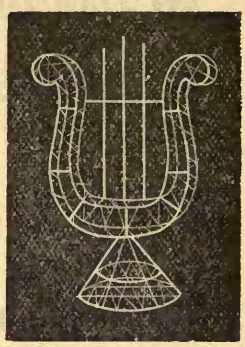
Cross.

10 inch	per doz,		$1 50
12 "	"	"	1 60
14 "	"	"	1 80
18 "	"	"	2 20
22 "	"	"	3 00
24 "	"	"	4 20

On Base, 25c. extra.

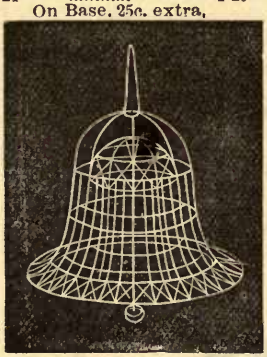
Crown.

8 inch	per doz.,		$ 6 00
10 "	"	"	8 40
12 "	"	"	10 80
13 "	"	"	12 00
15 "	"	"	18 00



Lyre.

12 inch	per doz.,		$ 7 80
15 "	"	"	9 00
18 "	"	"	10 20



Marriage Bell.

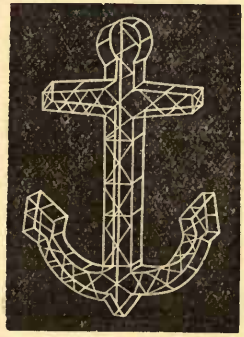
12 inch	per doz.,		$12 00
15 "	"	"	18 00
18 "	"	"	27 00
21 "	"	"	33 00
24 "	"	"	36 00

Star.

8 inch	per doz.,		$ 1 95
10 "	"	"	2 40
13 "	"	"	3 60
15 "	"	"	4 20
18 "	"	"	6 00

Harp.

12 inch	per doz.,		$ 7 80
16 "	"	"	9 00
18 "	"	"	10 20
21 "	"	"	13 20
24 "	"	"	15 00

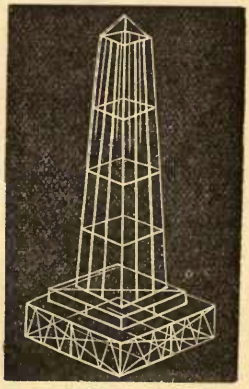


Anchor.

12 inch	per doz.,		$3 00
14 "	"	"	4 20
16 "	"	"	5 40
18 "	"	"	6 00

Square and Compass.

12 inch	per doz.,		$ 7 80
18 "	"	"	12 00
Doves	"	"	24 00
6 inch Letters	"	"	3 00
8 "	"	"	4 20
10 "	"	"	5 40

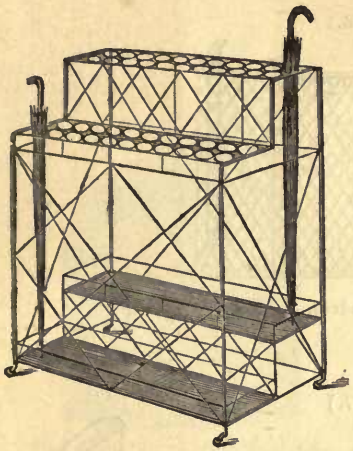


Monument.

12 inch	per doz.,		$ 6 00
15 "	"	"	9 00
18 "	"	"	12 60
21 "	"	"	16 20
24 "	"	"	21 00

Cane, Umbrella and Whip Stands.

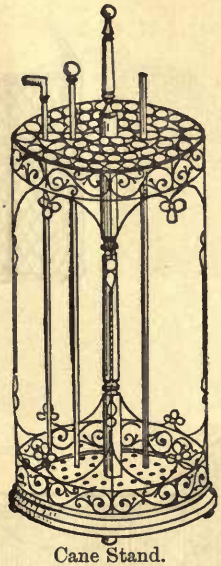
(Cut No. 72.)



Cane or Umbrella Stand.

28 inches long, with 32 holes.....$10 00
36 " " " 40 " 12 00

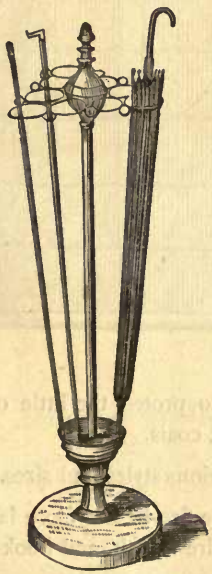
(Cut No. 73.)



Cane Stand.

30 inches high, as per cut, holding
74 Canes.....$15 00
The same, plainer..... 10 00

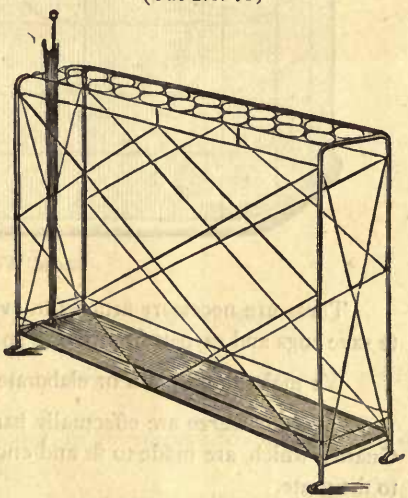
(Cut No. 74.)



Umbrellas and Cane Stand.

28 inches high, for Canes only.....$5 00
30 " " " and Umbrellas..... 6 00

(Cut No. 75)



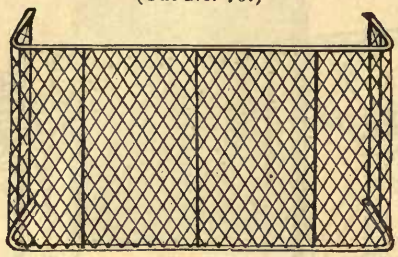
Umbrella and Whip Stand.

28 inches long, with 22 holes.....$ 8 00
36 " " " 30 " 10 00

Other Styles in Stock and Made to Order.

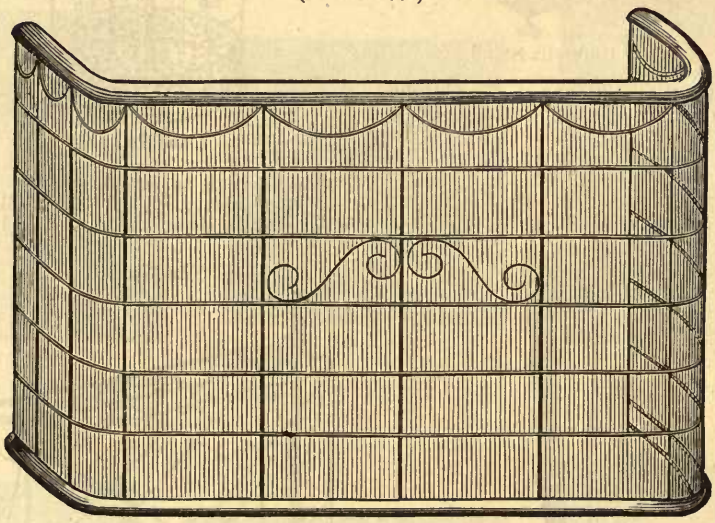
Fenders and Fire Guards

(Cut No. 76.)



Nursery Fenders.

(Cut No. 77.)



Laced Work Fenders.

These are necessary articles in every family, to protect the little ones, and to save rugs and carpets from flying sparks and hot coals.

We make them plain or elaborate, and of various styles and sizes.

Young Children are effectually barred from the fire by our close laced Fire Guards, which are made to fit and enclose the entire hearth, and hook securely to the grate.

Also, Guards for Stoves, Heaters, etc.

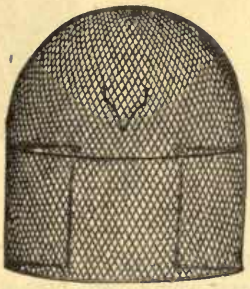
Fireplace Fenders, various designs, prices accordingly.

See page 38.

Fire Guards, Stove Guards, Etc.

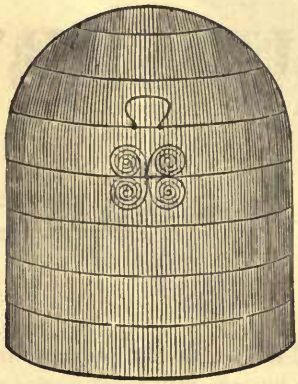
(Prices of Fire Guards on page 38.)

(Cut No. 78.)



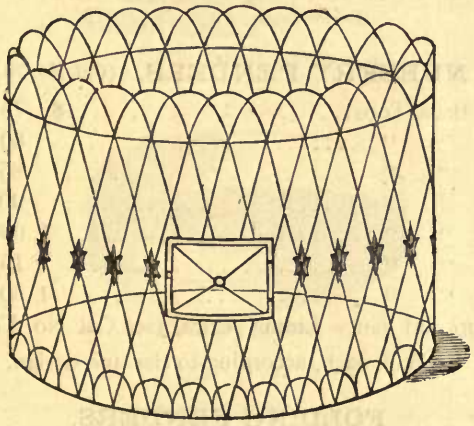
Spark Guards—Diamond Work.

(Cut No. 79.)



Spark Guards—Laced Work.

(Cut No. 80.)



Wire Stove Guards.

Made any size and height. Price, 50 cents per square foot.

Indispensable safeguards for Stoves, Heaters, etc., where there are young children.

Other styles and shapes made to order, to go entirely round the stove, or enclose three sides and hook to the wall.

They are made with door, as shown, for convenience in replenishing the fire, etc., at small additional cost.

In ordering, give height and diameter required, and distance of door from the floor.

PRICE LIST

— OF —

NURSERY FENDERS

— AND —

SPARK GUARDS.

☞We cannot too urgently advise the use of Fenders and Fire Guards, in the nursery, play-room, parlor and all apartments where open fires are kept.

Close Laced Fire Guards, of the best workmanship, made to fit the fire-place and fasten securely, with Ornamental Scroll Work, etc., $7.00 to $12.00 each.

NURSERY FENDERS. (Cut No. 76.)

12	inches	high,	Brass	Tops	$ 75	per running foot.
14	"	"	"	"	80	" " "
16	"	"	"	"	85	" " "
18	"	"	"	"	90	" " "
20	"	"	"	"	1 00	" " "
24	"	"	"	"	1 15	" " "
30	"	"	"	"	1 50	" " "

Silver Plated Top and Fancy Lining, extra, (see Cut No. 77) from $10.00 to $25.00 each, according to size and design.

FOLDING FENDERS.

18	inches	high,	Brass	Tops	$1 25	per running foot.
24	"	"	"	"	1 50	" " "
30	"	"	"	"	1 75	" " "

Fenders all Brass, three times above prices.

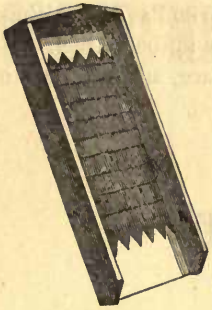
SPARK GUARDS.

18	inches,	as per	Cut No.	78	$20 00	per dozen.
20	"	"	"	78	25 00	" "
22	"	"	"	78	30 00	" "
24	"	"	"	78	35 00	" "

Brass Wire Guards, from $36.00 to $84.00 per dozen. (See Cut No. 79.)

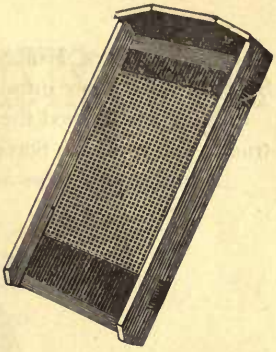
Screens, Riddles, Sieves, Etc.

(Cut No. 81.)



Sand Screen.

(Cut No. 82.)

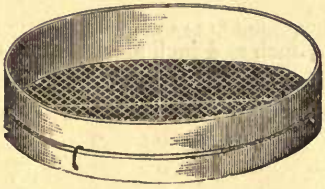


Coal and Ore Screen.

(Cut No. 83.)

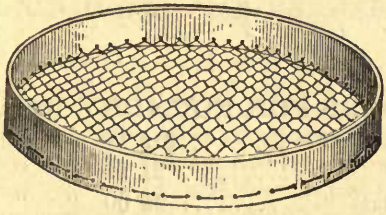
White Mortar Screen.

(Cut No. 84.)



Foundry Riddle.

(Cut No. 85.)



Barrel Cover.

Twisted 1½ inch Mesh, with Wood Rim, $7.50 per dozen.

For Prices, see pages 40.

IMPROVED

COAL, ORE & SAND SCREENS.

Coal Dealers, Miners, and others, will find our IMPROVED PARALLEL WIRE SCREENS vastly more durable and otherwise superior to any in the market.

By a new method the wires are locked securely in place, and will remain true to gauge till the Screen is worn out.

Furnished at prices as low as old style Screens.

PRICE LIST

— OF —

Coal, Ore & Sand Screens, Riddles, SIEVES, Etc.

Coal and Ore Screens, 1 inch to 2 inch Mesh	$12 00 each.
" " " ¼ " ⅞ " "	14 00 "
" " " 1 " 2 " " Heavy Oak Frames, Iron Bound	20 00 "
Coal and Ore Screens, ¼ inch to ⅞ inch Mesh, Heavy Oak Frames, Iron Bound	22 00 "
Improved Coal and Sand Screens, ⅛ inch Mesh	10 00 "
" " " " " 3-16 " "	10 00 "
" " " " " ¼ " "	10 00 "
" " " " " ⅜ " "	10 00 "
" " " " " ½ " "	10 00 "
" " " " " ⅝ " "	10 00 "
" " " " " ¾ " "	10 00 "
" " " " " 1 " "	10 00 "

RIDDLES FOR FOUNDRY USE, ETC.

18 inch diameter, Iron Wire	$15 00	per dozen.		
20 " " " "	21 00	" "	extra heavy, No. 2.	
18 " " Brass "	24 00	" "		
20 " " " "	32 00	" "	" "	"

MINERS' STEEL WIRE RIDDLES.

Heavy Steel Crimped Wire, ¾ to 1½ inch Mesh.....$36.00 per dozen.

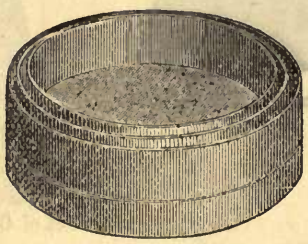
These are made out of heavy steel wire, 20 inches in diameter, and made especially for *miners' use.*

PRICE LIST

— OF —

FLOUR, MEAL AND DRUGGISTS' SIEVES

(Cut No. 86.)



Nest of Four Sieves.

FLOUR AND MEAL SIEVES.

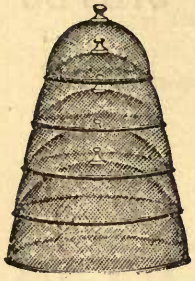
Plated Wire, 18 Mesh, 11, 12 and 13 inches diameter.....$2 50 per dozen.
" " 20 " " " " " ..... 3 00 " "
Brass " 20 " " " " " ..... 5 00 " "
" " 24 " " " " " ..... 6 00 " "

PRICES DRUGGISTS' SIEVES, PER DOZEN.

Mesh.	5 in.	6 in.	7 in.	8 in.	9 in.	10 in.	11 in.	12 in.	13 in.	14 in.	15 in.	16 in.	18 in.	20 in.	24 in.
2 to 20	$ 6.00	$ 6.00	$ 6.50	$ 6.50	$ 7.50	$ 8.00	$ 9.00	$10.00	$12.00	$14.00	$16.00	$18.00	$24 00	$32.00	$42.00
24	6.00	6.00	6.50	6.50	7.50	8.00	9.00	11.00	12 50	14 50	16.50	18.50	24.50	33.00	44.00
30	6.00	6.00	6.50	6.50	7.50	8.50	10.00	12.00	13.00	15,00	17.00	20.00	26.00	35.00	47.00
36 to 40	6.00	6.00	6.50	7 00	8 00	9.50	11.00	13.00	14.00	15.50	18.00	21.00	27.00	36.50	48.00
50	6.00	6.50	7.00	7.50	8.50	10.00	12.00	14.50	15.50	18.00	19.00	22.00	28.00	38.00	50.00
60	6.50	7.00	7.50	8.00	9.50	11.00	13.00	16.00	17.00	18.50	20.00	24.00	30.00	40.00	55.00
70	6.50	7.00	7.50	8.50	10.00	12.00	14.00	17.00	18.50	20.00	21.50	27.00	33.00	43.00	60.00
80	7.00	7.50	8.00	9.00	10.50	12.50	15.00	18.50	20.00	21.50	23.50	28.50	37.00	47.00	65.00
90	7.00	7.50	8.20	9.50	11.50	13.50	16.50	20.00	22.50	25.00	28.50	33.50	42.00	52.50	70.00
100	7.50	8 00	9.00	10.00	12.50	15.00	17.50	21.00	25 00	30.00	35.00	40.00	47.50	57.50	75.00

DISH COVERS.

(Cut No. 87.)

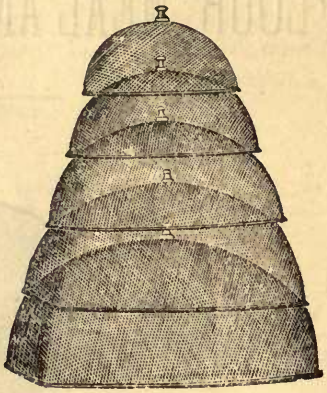


Set of Round Wire Dish Covers.

(Cut No. 88.)

Round Wire Dish Cover.

(Cut No. 89.)



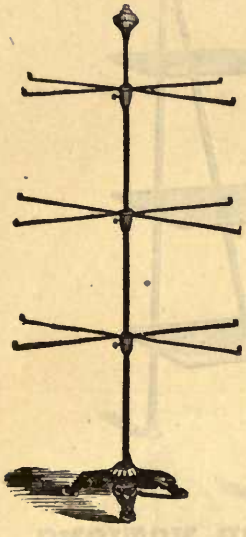
Set of Oblong Wire Dish Covers.

DISH COVERS.

Round, 6, 7, 8, 9 and 10 inches	$1 00	per nest (of 5)
Oval, 8, 10, 12, 14 and 16 inches	2 60	" " "
Oblong, 8, 10, 12, 14 and 16 inches	3 35	" " "
Round, 6 inch	1 50	per dozen.
" 7 "	1 75	" "
" 8 "	2 25	" "
" 9 "	2 75	" "
" 10 "	3 25	" "
" 12 "	7 00	" "
" 14 "	9 50	" "
Oval, 8 "	3 25	" "
" 10 "	4 75	" "
" 12 "	6 25	" "
" 14 "	7 75	" "
" 16 "	9 25	" "
Oblong, 8 "	4 00	" "
" 10 "	6 00	" "
" 12 "	8 00	" "
" 14 "	10 00	" "
" 16 "	12 00	" "

SHOW STANDS, WINDOW FIXTURES, ETC.

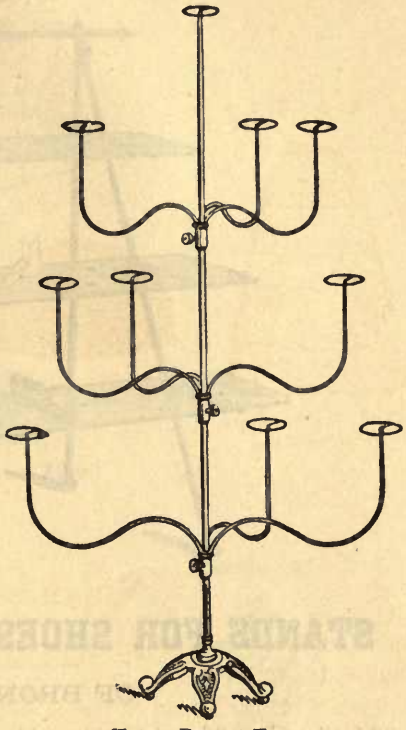
(Cut No. 90.)



Cravat Stand.

9 Branches.....$3 00

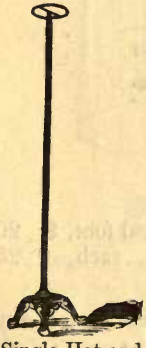
(Cut No. 91.)



Hat or Bonnet Tree.

With Adjustable Slides.....$3 50

(Cut No. 92.)

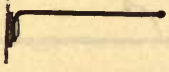


Single Hat and Bonnet Stand

No. 0, 10 to 14 inches, per dozen.$2 00
" 1, 12 to 18 " " " . 3 00
" 2, 20 to 24 " " " . 4 50
" 3, 26 to 30 " " " . 6 00
" 4, 36 to 46 " " " . 7 50
" 5, 48 to 54 " " " . 9 00

For Show Windows, Counters, etc.
Neatly Finished in Bronze.

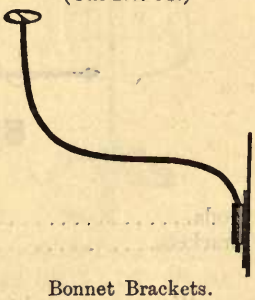
(Cut No. 93.)



Show Window Brackets.

16 in., bronzed, $3 50 per dozen.
18 " " 4 00 " "
20 " " 5 00 " "
24 " " 6 00 " "

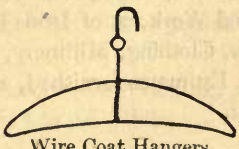
(Cut No. 94.)



Bonnet Brackets.

Plated Wire.$1 25 per doz.

(Cut No. 95.)



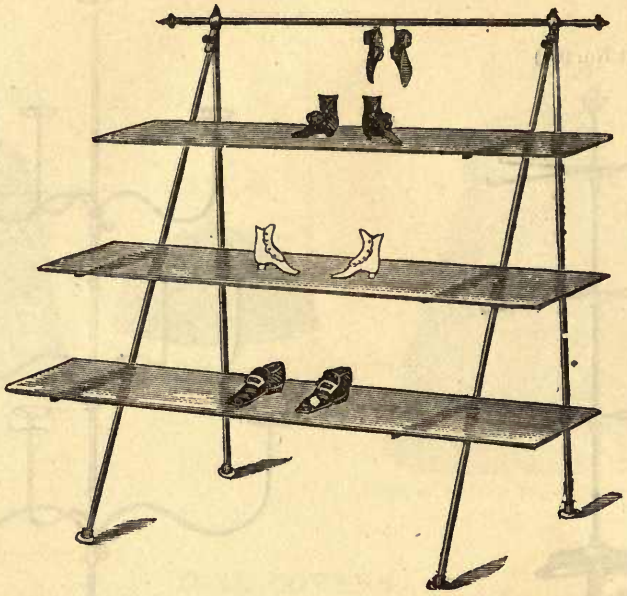
Wire Coat Hangers.

Per dozen..... 75 cts.

Used for hanging up coats and vests in Stores, Wardrobes and Closets.

SHOW STANDS, STORE FIXTURES, Etc.

(Cut No. 96.)



STANDS FOR SHOES, HATS OR NOTIONS.

OF BRONZED IRON.

36 inches high, 36 inches wide, with three Wire Shelves.....$10 00
42 " " 42 " " " " " " " 11 00

(Cut No. 97.)

STORE FIXTURES.

OF BRONZED IRON.

Rods.....per lineal foot, $ 20
Brackets.....each, 1 25

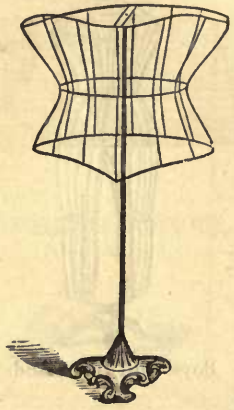
We are prepared to furnish, at short notice, and on the best terms, any style of Show Stands, Window and Store Fixtures, Brackets and Arms, Counter Stands, Upright and Suspended Rods, Wire Shelves, etc., of Brass or Plated Work, or of Iron Tube, Painted or Bronzed, for the display of Shoes, Hats, Clothing, Millinery, Fancy and Furnishing Goods.

Estimates furnished, and work put up when required, with skill and dispatch.

Wire Figures, Forms, Stands, Etc.

All Sizes and Descriptions, in Stock and to Order.

(Cut No. 98.)



Corset Frame.

Each.....$2.00

(Cut No. 99.)

Mantilla and Dress Stand.

$2 50, $3 00, $3 25.

(Cut No. 100.)

Girls' Dress Form.

$2 00, $2 50, $3 00.

We make these Dress Figures to represent the Latest Fashions; also, to special order and measure for Modistes, and ladies who require exactness in contour, size, etc.

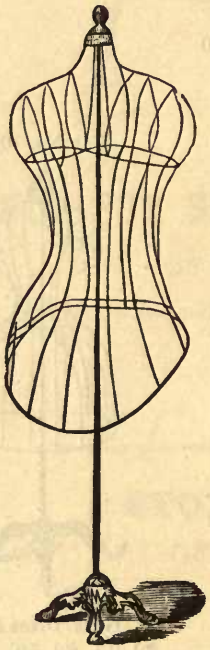
Our Forms are much more strongly made, of more stylish outline, and of better workmanship than the common articles offered to the public.

Wire Figures, Suit Frames, Etc.—Continued.

(Cut No. 101.)

Boys' Full Suit Stand.

(Cut No. 102.)



Coat and Vest Stand.

(Cut No. 103.)

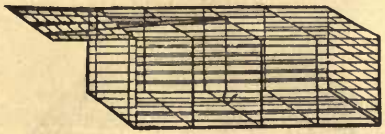
Man's Suit Frame.

No. 1, Boy's,	27	inches high	.....	each,	$2 50
" 2, "	32	" "	.....	"	3 00
" 3, "	36	" "	.....	"	3 50
" 4, "	46	" "	.....	"	4 50
" 1, Youth's,	54	" "	.....	"	5 00
" 1, Man's,	60	" "	.....	"	6 00
Coat Frames, full man's size			.....	"	3 00

RAT AND MOUSE TRAPS.

COMMON SQUARE RAT TRAP.

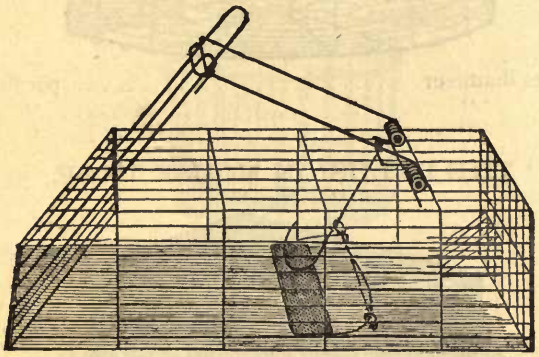
(Cut No. 104.)



Price, size 12x7x3½ inches.....$5 00 per dozen.
" " 12x8x4 " ..... 6 00 " "

PATENT LEVER SPRING BEVEL END RAT TRAP.

(Cut No. 105.)

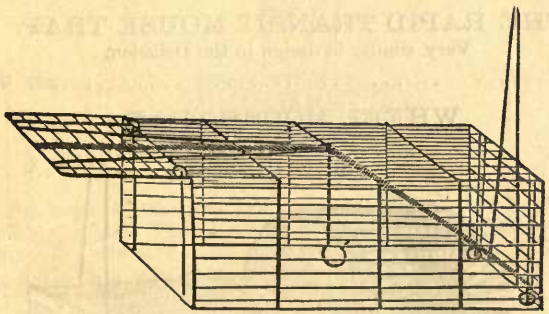


Wire Bottom—Size, 15x9x5 inches.

Price with back door.....per dozen, $10 50
" without " " ..... " " 9 00

SQUARE, DOUBLE END. (TWO DOORS.)

(Cut No. 106.)



Wire Bottom—Size 15x9x5 inches.

Price.....per dozen, $12 00

OUR "PATENT LOCK GALVANIZED TRAP."

Made of CRIMPED WIRES, and put together in such a manner that they cannot be displaced. The whole Trap is Galvanized *after being made*, by dipping them, thus making it *absolutely rust proof.*

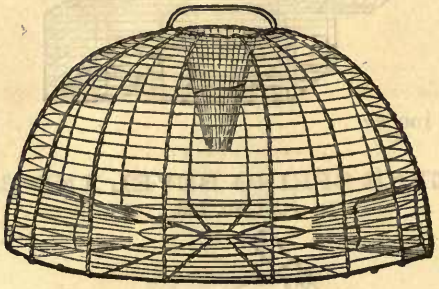
Size, 15x8x6 Inches.

Price, with back door.....per dozen, $10 50
" without " ..... " " 9 00

Rat and Mouse Traps.—Continued.

ROUND, SELF-SETTING RAT TRAP, WIRE BOTTOM.

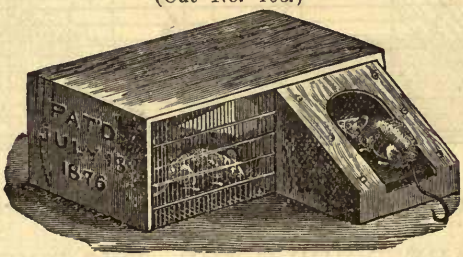
(Cut No. 107.)



Price, 12 inches diameter ..... per dozen, $12 00
" 14 " " ..... " " 18 00
" 18 " " ..... " " 30 00

THE DELUSION MOUSE TRAP.

(Cut No. 108.)



Price ..... per dozen, $3 00

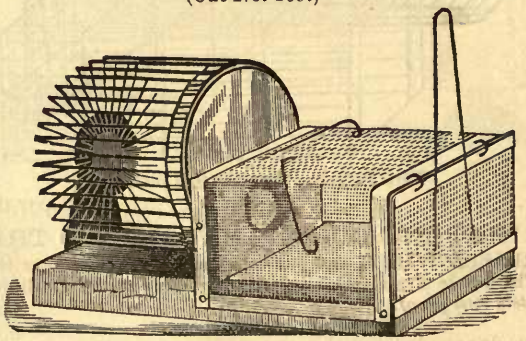
THE RAPID TRANSIT MOUSE TRAP.

Very similar in design to the Delusion.

Price ..... per dozen, $2 50

WHEEL MOUSE TRAP.

(Cut No. 109.)



Size of Bottom, 6½x3 inches.

Price ..... per dozen, $3 00

CORN POPPERS.

(Cut No. 110.)

Round, holds 1 quart	$2 00	per dozen.
Square, No. 1, holds 1 quart	2 00	"
" " 3, extra large, holds 2 quarts	4 00	"
Novelty Patent, holds 2 quarts	4 00	"

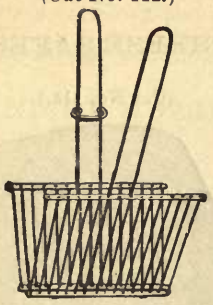
VEGETABLE BOILERS.

(Cut No. 111.)

6 inch diameter, 4½ inches deep	$6 00	per dozen
7 " " 5 " "	6 50	"
8 " " 6 " "	7 00	"
9 " " 7 " "	7 50	"

WIRE STEAK BROILERS.

(Cut No. 112.)



PATENT REVERSIBLE BROILERS AND TOASTERS, (⅝ in. spaces). Extra heavy and strong, with Patent Slide. These Broilers are the best in the market, being made of steel wire retinned, the bars of which *cannot work loose.*

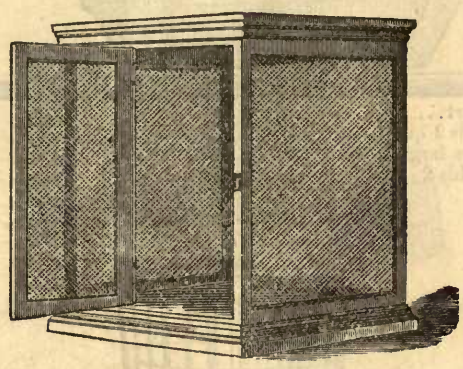
No. 1, Size, 6 inches by 9 inches	$3 00	per dozen
" 2, " 7½ " 9 "	3 38	"
" 3, " 9 " 9 "	3 75	"
" 4, " 10½ " 9 "	4 25	"
" 5, " 12 " 9 "	5 00	"
" 6, " 13½ " 9 "	5 75	"

PATENT OYSTER BROILERS. (¼ Inch Spaces.)

No. 1, Size, 6 inches by 9 inches	$5 00	per dozen
" 2, " 7½ " 9 "	5 75	"
" 3, " 9 " 9 "	6 50	"
" 4, " 10½ " 9 "	7 25	"

Meat and Provision Safes.

(Cut No. 113.)

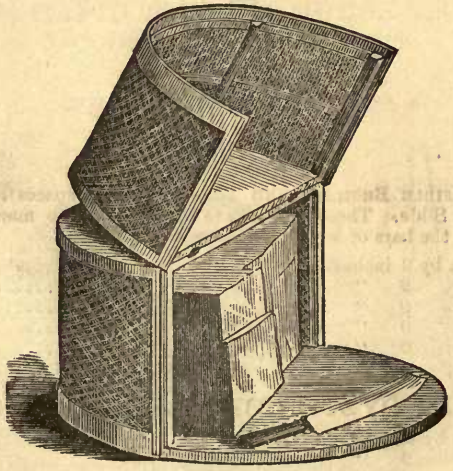


Portable Meat Safe.

Size, 17 inches wide, 17 inches deep, 19 inches high.. .. ..$3 50 each.
" 21 " " 21 " " 23 " " ..... 4 25 "
" 25 " " 25 " " 27 " " . ..... 5 00 "

CHEESE SAFES.

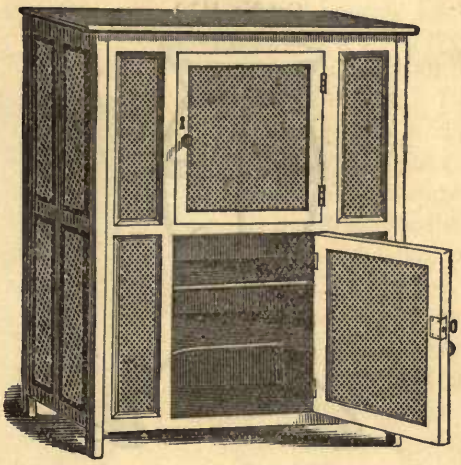
(Cut No. 114.)



Cheese Safe. Price from $3 00 to $4 00 each.

Meat and Provision Safes—Continued.

(Cut No. 115.)



DOUBLE SAFE.

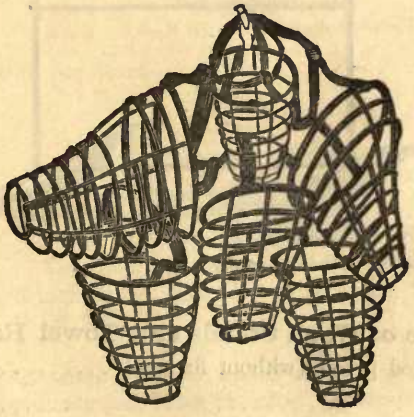
No. 1, 4 shelves, 37 inches wide, 16 inches deep, 50 inches high.....$12 50
" 2, 5 " 44 " " 16 " " 57 " " 15 00

Handsomely varnished, with figured wire cloth on the two doors, and at each end, which gives free circulation of air, and protects the meat, milk, etc., from flies, insects and vermin. Every family should have one.

They are a handsome piece of furniture, and occupy very little room.

DOG AND OX MUZZLES.

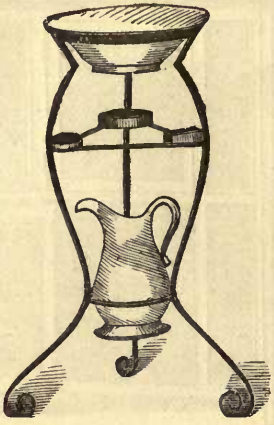
(Cut No. 116.)



Dog Muzzles.....$5 00 per dozen.
Ox " .....12 00 "

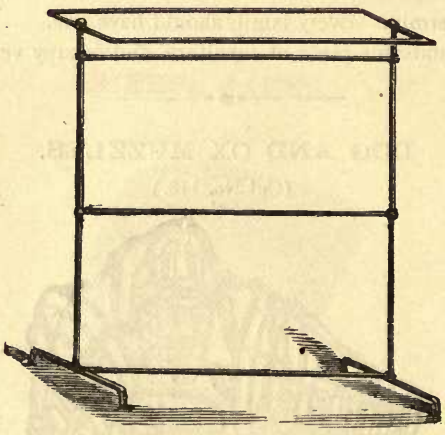
Wash Stands and Towel Racks.

(Cut No. 117.)



Wash Stand.

(Cut No. 118.)



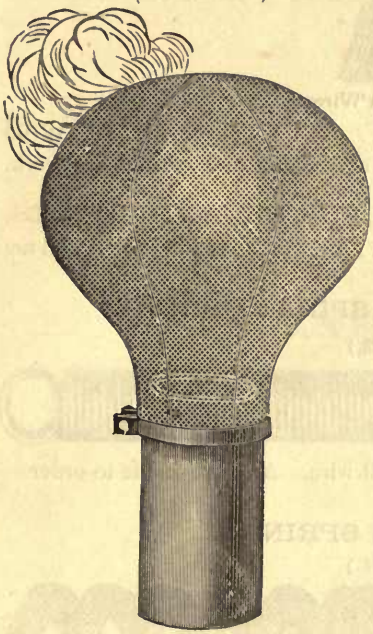
Towel Rack.

Price of Wash Stands and Towel Racks.

Wash Stands, painted green, (without fixtures).....$30 00 per dozen.
Towel Racks, " " ..... 21 00 " "

SMOKE STACK BONNETS.

(Cut No. 119.)



Showing Bonnet attached to Smoke Stack.

These Bonnets or Spark Guards are made with a strong iron frame, and covered with No. 4, 5 or 6 mesh heavy spark catcher wire cloth. They are adjusted at the bottom so as to clasp the stack firmly and hold it in its place. Mills, Foundries, machine shops, factories, hotels and every other building, should protect their own, as well as adjoining property, with these coverings. They can be made any size, and to fit round or square, iron or brick chimneys, and no spark can get through them. A high wind creates a strong draft, which carries live coals into the air and on to the buildings.

In ordering, state whether the stack is round or square, and give the outside diameter at the extreme top, and also four inches below. For dwelling houses they are made smaller and of gothic shape, which improves the general appearance of the chimney.

STEEL WIRE CASTING BRUSHES.

(Cut No. 120.)

No. 3. 4 inch wire, with leather handle.

No. 1, 2 inch wires, per dozen	$ 8 00
" 2, 3 " " "	9 00
" 3, 4 " " "	10 00

(Cut No. 121.)

Two rows, 3 inch wires, with wood handle.

No. 4, two rows, 3 inch wires, with wood handle, per dozen	$ 8 00
" 5, three " 2 " " " " " " " "	9 00
" 6, " " " 3 " " " " " " " "	10 00

The 2 inch Brushes are used where a hard, stiff brush is required, and 3 and 4 inch for ordinary and stove castings These Brushes are made of the best flat steel spring wire, and on the most approved principle, large sizes and well-finished.

STEEL WIRE CASTING BRUSHES.

(Cut No. 122.)

No. 7. Six Inch Wires.

No. 7, Six inch Wires, per doz $12 00

No. 7 Brushes are used for cornices, corners, crevices, and ornamental work.

FILE CARD, OR WIRE BRUSH, FOR CLEANING FILES.

Price ..... $2 50 per dozen net

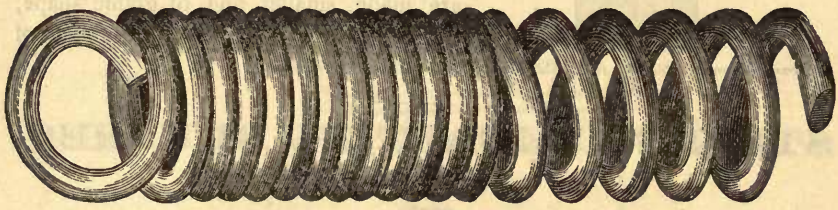
SMALL COILED WIRE SPIRAL SPRING.

(Cut No. 123.)

Showing close coil, $\frac{3}{8}$ in. diameter, No. 19 wire. Any size made to order.

COILED SPIRAL SPRINGS.

(Cut No. 124.)



This end shows close coil, No. 9 wire, and 1 inch diameter. This end open coil, No. 7 wire.

PRICE OF BRASS WIRE COILED SPRINGS.

No.	3 to 6	wire, coiled,	$\frac{3}{4}$ to $2\frac{1}{2}$	in. diameter, per lb.					$ 60
"	7 to 9	"	"	$\frac{5}{8}$ to 2	"	"	"	"	65
"	10 to 14	"	"	$\frac{3}{8}$ to $1\frac{1}{2}$	"	"	"	"	70
"	16 and finer,	"	"	$\frac{1}{4}$ to 5	"	"	"	"	1 25

Open coil is to push together. Close coil is to pull out.

Price of Coppered Bessemer Steel Spring Wire, Coiled Springs.

No.	4 to 8	wire, coiled,	$\frac{3}{4}$ to $2\frac{1}{2}$	in. diameter, per lb.					$ 30
"	7 to 10	"	"	$\frac{1}{2}$ to 2	"	"	"	"	35
"	11 to 16	"	"	$\frac{3}{8}$ to $1\frac{1}{4}$	"	"	"	"	40

A spring, to be effective, should be coiled upon the most approved machinery, and if coiled evenly and properly will last longer and have more elasticity and strength than one made of the same wire and not properly coiled. Any size and shape made to order.

Price List Brass and Copper Wire.

	High Brass per lb.	Spring Brass per lb.	Low Brass per lb.	Copper per lb.
Nos. 0 to 20	33	35	37	43
" 21	36	38	40	46
" 22	37	39	41	47
" 23	38	40	42	48
" 24	40	42	44	50
" 25	43	45	47	53

FINE WIRE.

	High Brass per lb.	Spring Brass per lb.	Low Brass per lb.	Copper per lb.
No. 26	45	47	49	55
" 27	48	50	52	58
" 28	52	54	56	63
" 29	55	57	59	66
" 30	58	60	62	72
" 31	62	64	66	78
" 32	66	68	70	84
" 33	70	72	74	93
" 34	74	76	78	1.03

EXTRA FINE WIRE.

	Low Brass per lb.	Copper per lb.
No. 35	82	1.10
" 36	89	1.22
" 37	1.05	1.35
" 38	1.35	1.87
" 39	1.85	2.50
" 40	2.32	5.00

Flat, Square, and Half-Round Wire 5 cents per pound advance on Round Wire.

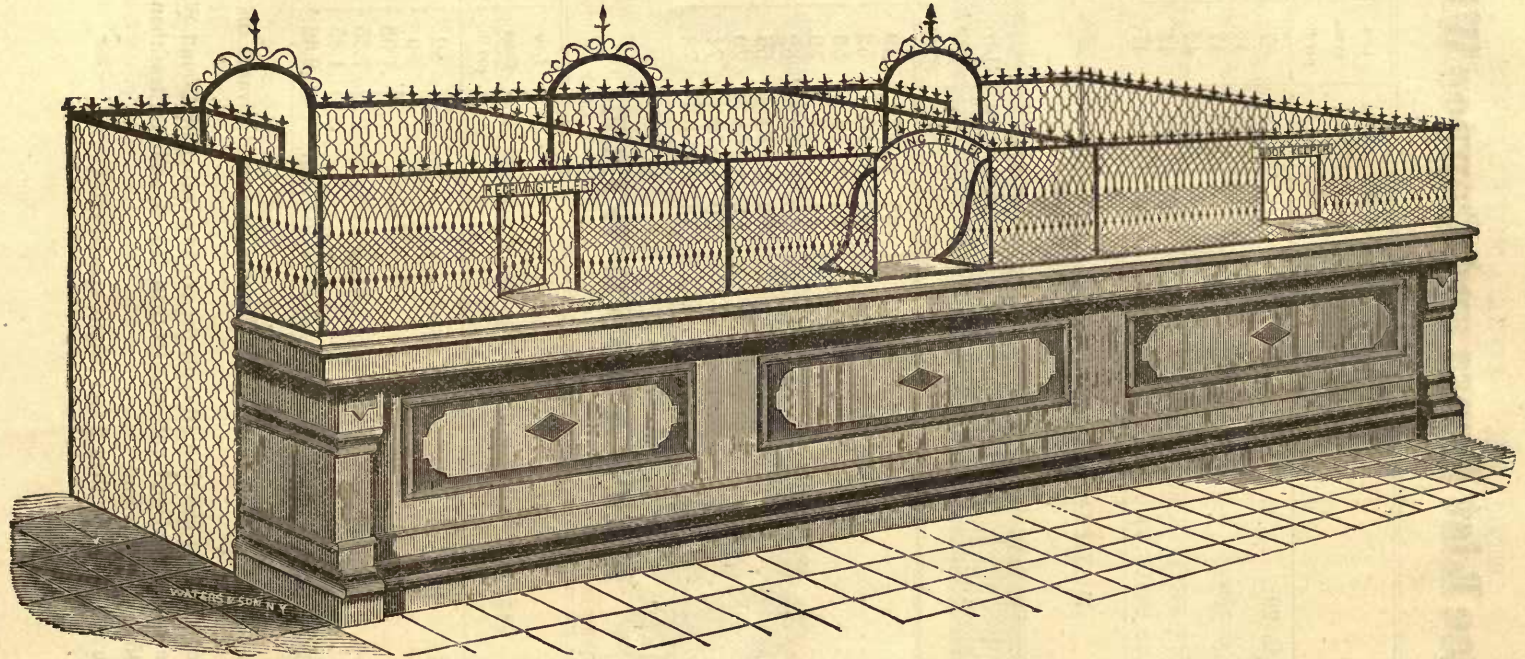
Fancy Wire not less than 10 cents per pound advance of Round Wire.

Wire straightened and cut, smaller than No. 8, and not less than 2 feet lengths, 45 cents per pound.

Wire and Rods less than 2 feet length, special rates.

INTERIOR OF A BANKING ROOM.

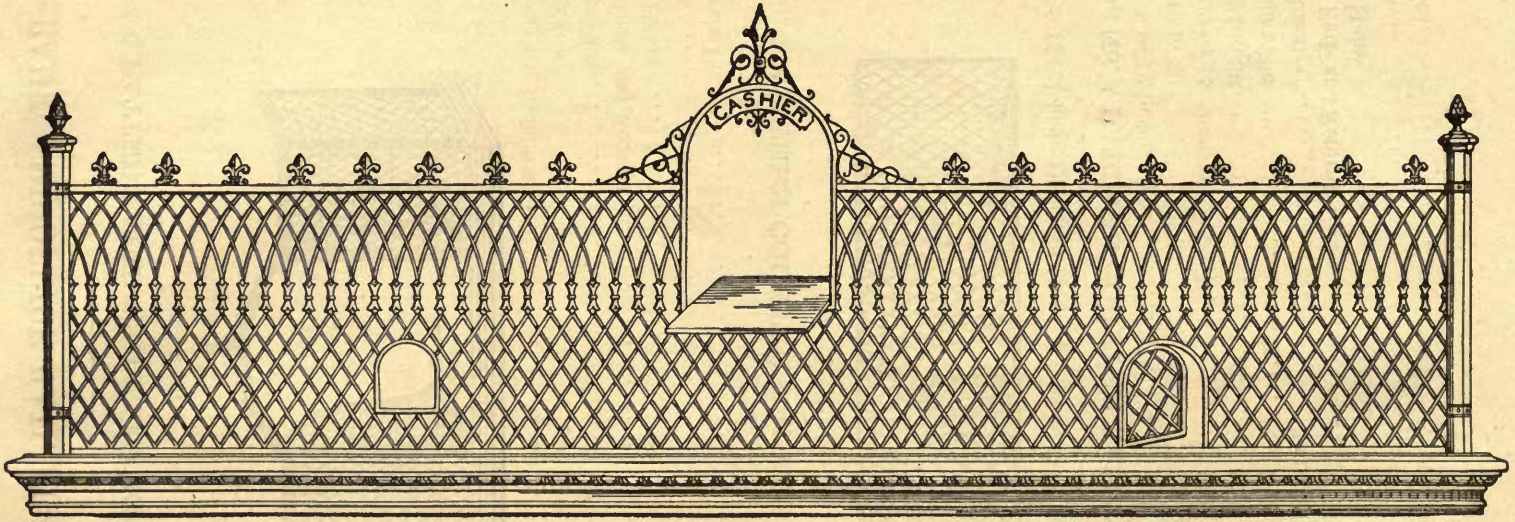
(Cut No. 125.)



Above we show the interior view of a Banking Room, in which the Tellers are enclosed with No. 9 and No. 14 Pattern Wire Railing. The great advantage in Tellers being thus securely enclosed from intrusion of fellow clerks, or others, is apparent. It is appreciated, and has been adopted by many of the largest banking institutions in the country. Estimates furnished, and work put up, when required.

BANK AND OFFICE RAILING—GOTHIC AND DIAMOND DESIGN.

No. 11 Pattern. (Cut No. 126.)



This is a general Bank and Office Railing, of excellent design and attractive appearance—A much more effective protection against sudden assault or theft than glass or railing of other material. The wires are strongly interlocked, and worked into a substantial wrought iron frame, surmounted with ornamental pickets, and with rosettes at the intersection of the wires. This railing is made to conform to any shape of counter, and of any required height, with or without cash holes, gates or extra posts; it is finished in any color desired, and gold bronzed.

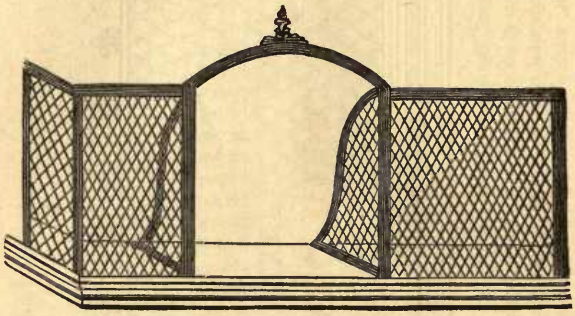
Price per lineal foot, 24 inches high..... .....$2 70
" " " " 30 " " 3 10
" " " " 36 " " 3 75

Ordinary Posts, Pickets and Rosettes are included in above prices. Cash Holes, $2 50 to $5 00 each extra. Fancy Posts, $2 50 to $5 00 each extra. Estimates promptly furnished on receipt of dimensions and description of work, (accompanied with diagram if possible).

BANK AND OFFICE RAILING—Continued.

No. 4 PATTERN COUNTER RAILING.—Square Frame.

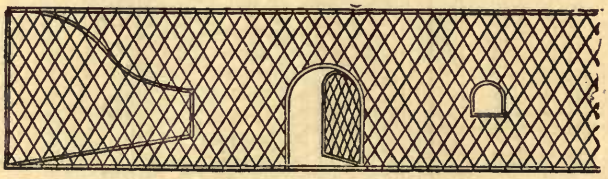
(Cut No. 127.)



Not less than 18 inches high.....70 cents per square foot.
For Pickets.....30 cents per running foot, extra
" Rosettes.....30 " " " " "
Ogee Ends and Returns.....$2 00 each, "
Cash Holes..... 3 00 "
Doors..... 4 50 "
Locks on Doors..... 2 00 "

No. 4 PATTERN COUNTER RAILING—Round Frame.

(Cut No. 128.)



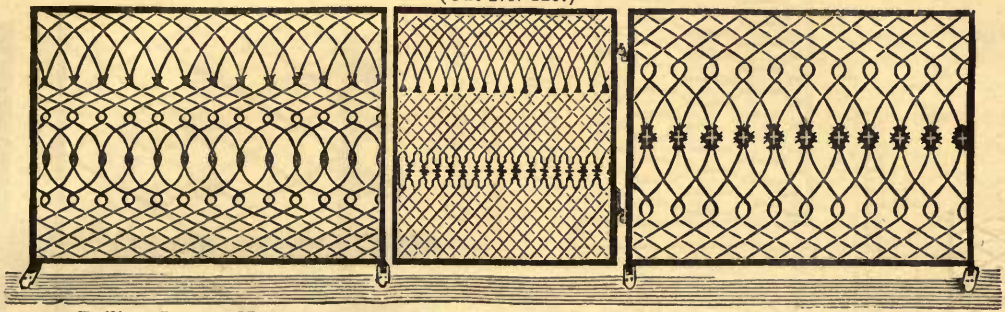
Of $1\frac{1}{4}$x$2\frac{1}{2}$ inch Diamond Mesh, $\frac{1}{8}$ inch Wire, $\frac{3}{8}$ inch Round Frame.

Prices No. 4 PATTERN COUNTER RAILING—Round Frame.

From 6 to 12 inches high.....$ 70 cents per running foot.
" 12 to 20 " " ..... 85 " " " "
" 20 to 24 " " ..... 1 00 " " " "
" 24 to 30 " " ..... 1 25 " " " "
" 30 to 36 " " ..... 1 50 " " " "
For Rosettes.....30 cents per running foot, extra.
Ogee Ends and Returns.....$1 00 each, extra.
Cash Holes..... 1 50 " "
Doors..... 2 50 " "
Latches..... 1 00 " "

WIRE RAILING, FENCES, GATES, Etc.

(Cut No. 129.)



Railing, Pattern No. 16. Railing, Pattern No. 14. Railing, Pattern No. 12.

Prices of Office Railing, Etc., 32 inches High.

Pattern No.	Cut No.	Size of Wire.	No. of Wire.	Description of Mesh.	Price per Running Foot.
" 4	" 134	" 1-6 inch.	No. 8	2x4 inches, Diamond.	$2 50 " "
" 4	" 134	" 1-4 "	No. 3	3x6 " "	2 75 " "
" 9	" 135	" 1-6 "	No. 8	2x4 inches, Double Crimp.	2 75 " "
" 11	" 137	" 1-4 "	No. 3	Gothic and Diamond.	3 00 " "
" 12	" 138	" 1-6 "	No. 8	Globe and Diamond.	3 25 " "
" 12	" 138	" 1-4 "	No. 3	" " "	3 50 " "
" 14	" 141	" 1-8 "	No. 10	Gothic and Diamond.	4 00 " "
" 15	" 140	" 1-4 "	No. 3	Gothic and Long Diamond.	3 75 " "
" 16	" 142	" 1-4 "	No. 3	Gothic, Globe and Diamond.	3 75 " "

Extra charge for Pickets..... 30 " "
" " " Rosettes..... 30 " "
" " " Posts, (not essential)..... 2 00 each.
" " " Gates.....from $6 to $10.00 each.

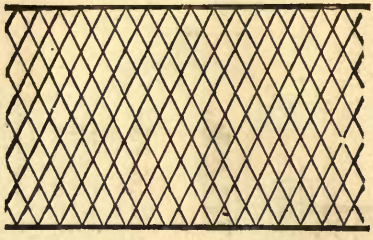
☞The above Prices include Painting and Bronzing.

WIRE RAILING.

Fences, Guards, Gates, Etc.

Cut No. 130.)

For Prices

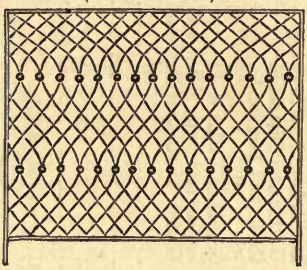


See Page 74.

Plain Diamond Wire Work.

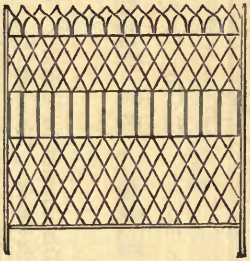
WIRE FENCE, GUARDS OR RAILING.

(Cut No. 131.)



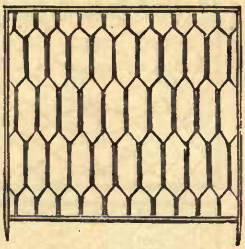
Wire Fence,
Guards or Railing, No. 1 Pattern.

(Cut No. 132.)



Wire Fence, etc.,
No. 2 Pattern.

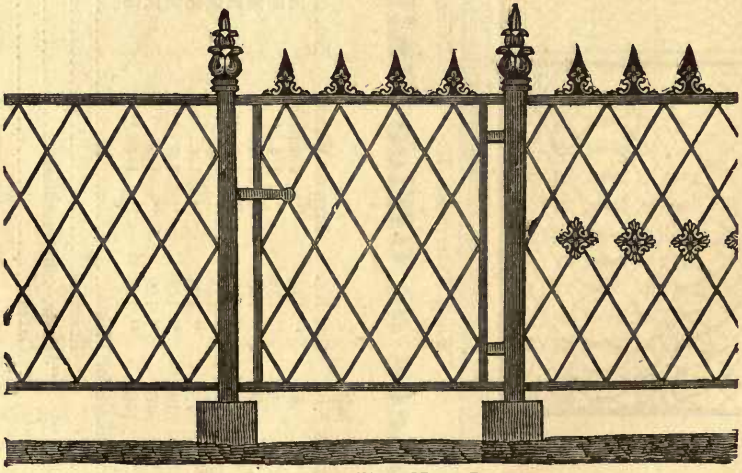
(Cut No. 133.)



Wire Fence, etc.
No. 3 Pattern.

(Cut No. 134.)

Plain. With Pickets. Pickets and Rosettes.



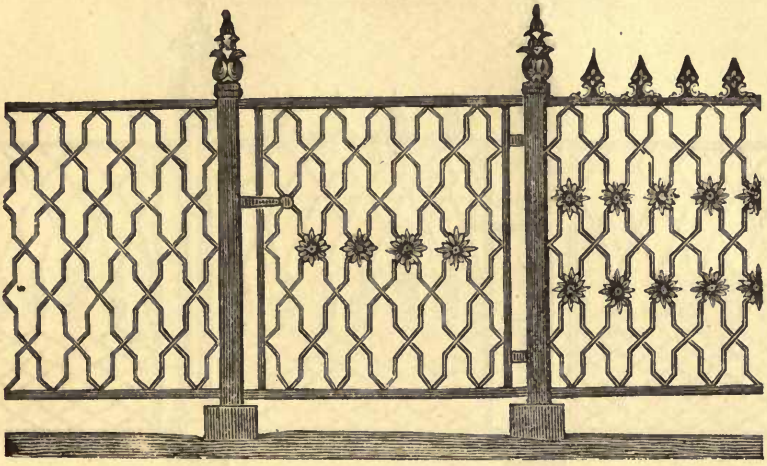
Wire Fence or Railing, No. 4 Pattern.

For Prices of above see page 66.

WIRE FENCES, GUARDS OR RAILING—Continued.

Plain. With Rosettes. Pickets and Two Lines Rosettes.

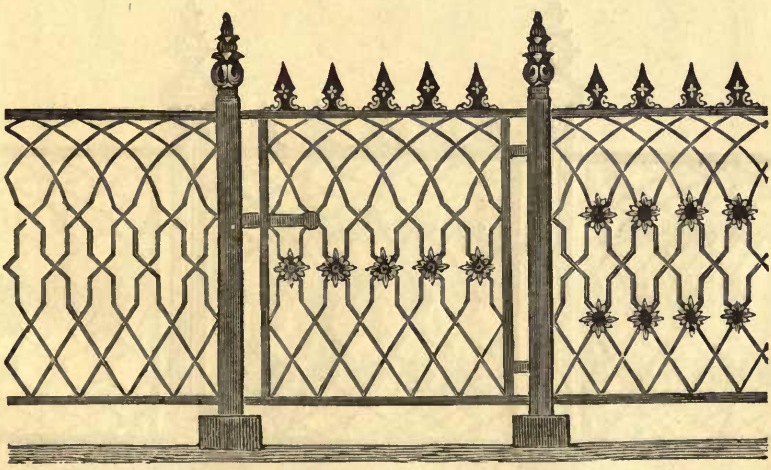
(Cut No. 135.)



Wire Fence, Guards or Railing, No. 9 Pattern.

Plain. Pickets and Rosettes. Pickets and Two Lines Rosettes.

(Cut No. 136.)



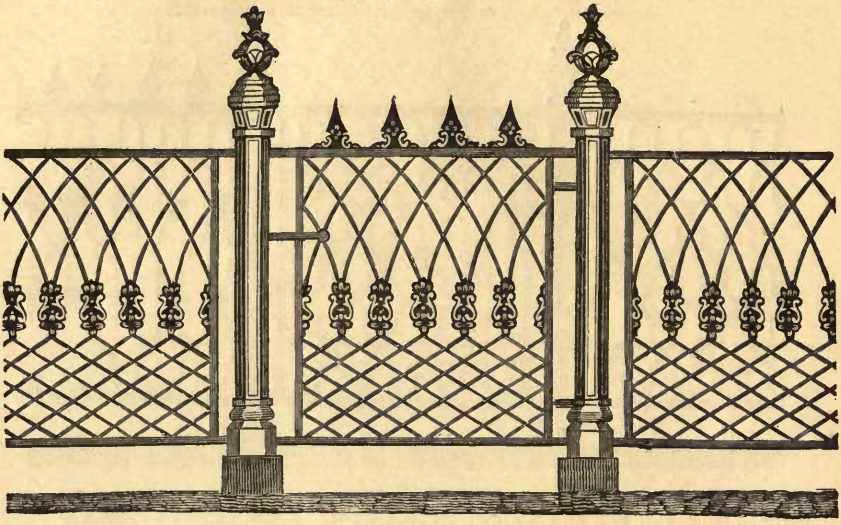
Wire Fence, Guards or Railing, No. 10 Pattern.

For Prices of above see page 66.

WIRE FENCE, GUARDS OR RAILING.—Continued.

With Pickets.

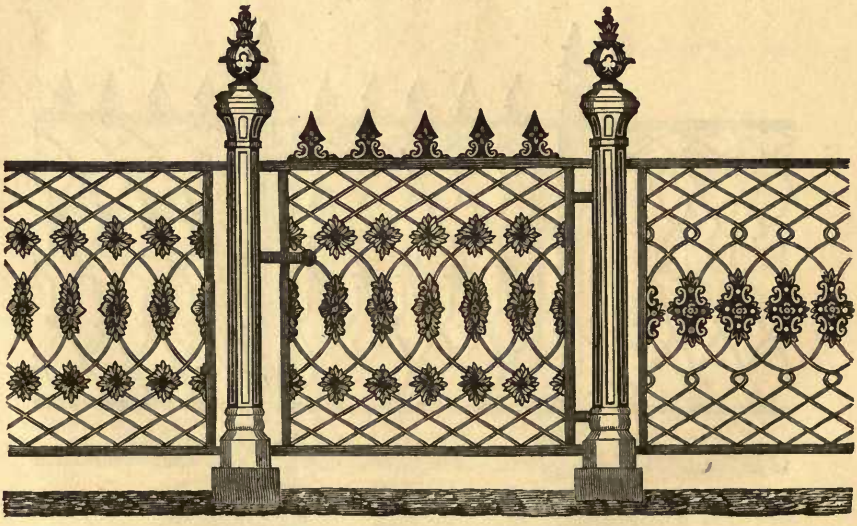
(Cut No. 137.)



Wire Fence, Guards or Railing, No. 11 Pattern.

(Cut No. 138.)

With Two Lines Rosettes. Pickets and Two Lines Rosettes. Plain.



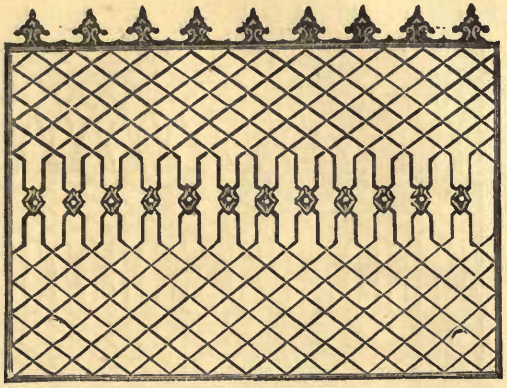
Wire Fence, Guards or Railing, No. 12 Pattern.

For Prices of above see page 66.

UNIVERSITY OF CALIFORNIA

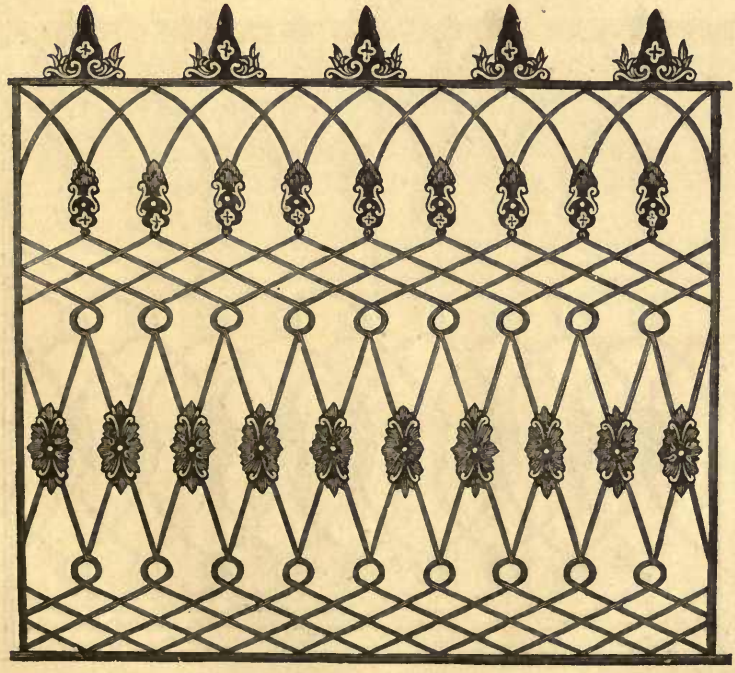
WIRE FENCE, GUARDS OR RAILING.—Continued.

(Cut No. 139.)



Wire Fence, Guards or Railing, No 13 Pattern.

(Cut No. 140.)

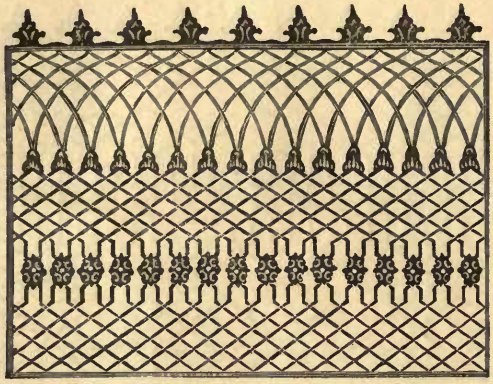


Wire Fence, Guards or Railing, No. 15 Pattern.

For Prices of above see page 66.

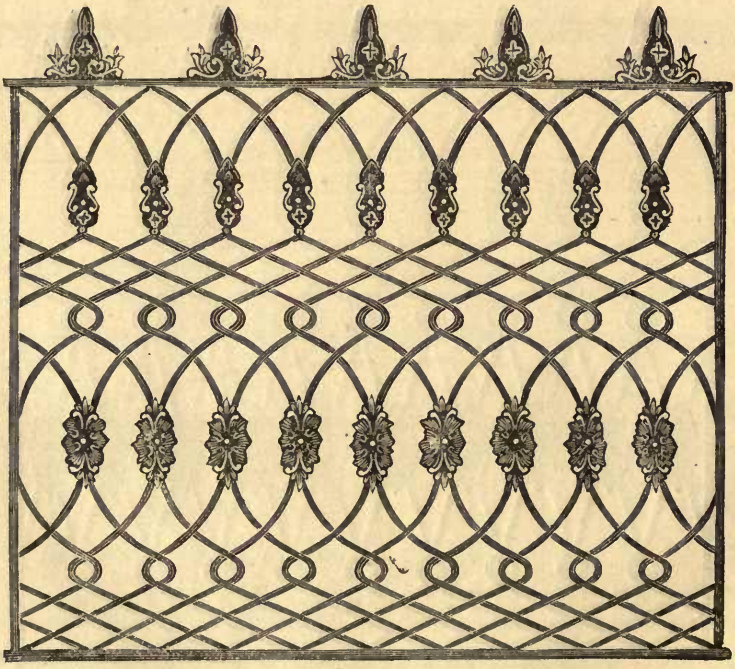
WIRE FENCE, GUARDS OR RAILING.—Continued.

(Cut No. 141.)



Wire Fence, Guards or Railing, No. 14 Pattern.

(Cut No. 142.)

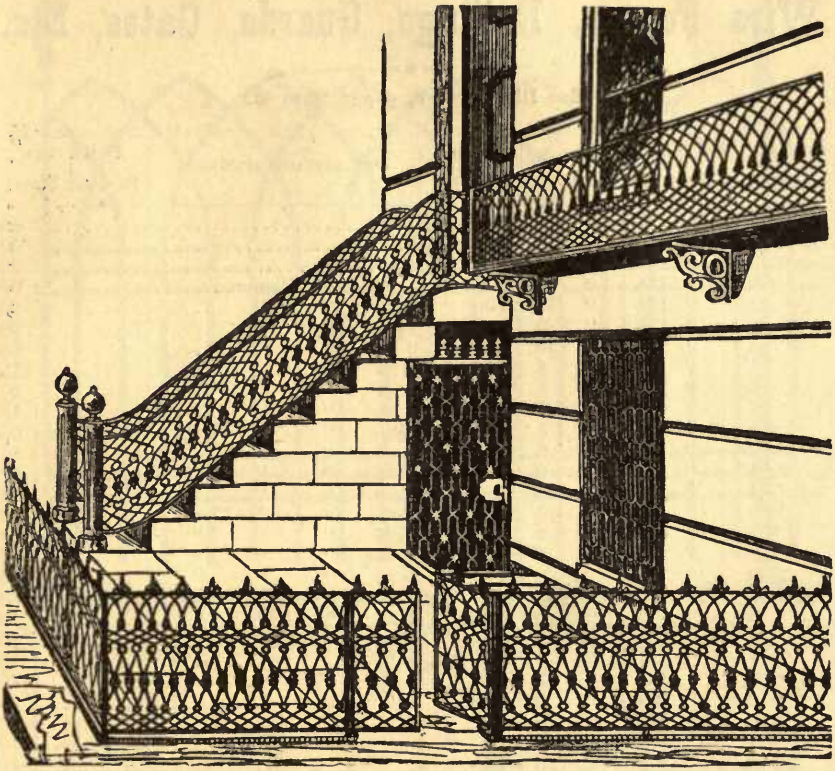


Wire Fence, Guards or Railing, No. 16 Pattern.

For Prices see page 66.

WIRE FENCE, GUARDS OR RAILING.—Continued.

(Cut No. 143.)



On the Door, No. 9 Pattern, Wire Guard.
On the Window, No. 53 Pat., Flat Iron Guard.
On the Balcony, No. 11 Pattern, Wire Railing
Balustrade, from No. 12 Pattern Railing.
Fence from No. 15 Pattern Railing.

(Cut No. 144.)

No. 16 Pattern, Drive Way Gates.

For Prices of the above, see page 66.

DESCRIPTIVE AND PRICE LIST

— OF —

Wire Fences, Railings, Guards, Gates, Etc.

See Illustrations, pages 60 to 65.

Pattern Number.	Cut Number.	Wire Number.	Size of Wire.	Description of Mesh.	Price per Square Foot.
No. 1	No. 131	No. 8	1-6 inch.		$1 25
" 2	" 132	" 10	1-8 "		60
" 3	" 133	" 5	7-32 "		1 25
" 4	" 134	" 10	1-8 "	1 x2 inch, Diamond	1 00
" 4	" 134	" 10	1-8 "	1¼x2½ " "	90
" 4	" 134	" 9	1-7 "	1½x3 " "	90
" 4	" 134	" 10	1-8 "	2 x4 " "	65
" 4	" 134	" 8	1-6 "	2 x4 " "	75
" 4	" 134	" 6	3-16 "	2 x4 " "	90
" 4	" 134	" 3	1-4 "	2 x4 " "	1 15
" 4	" 134	" 3	1-4 "	2½x5 " "	1 00
" 4	" 134	" 3	1-4 "	3 x6 " "	85
" 4	" 134	" 0	5-16 "	4 x8 " "	1 00
" 4	" 134	" 000	3-8 "	4½x9 " "	1 20
" 9	" 135	" 10	1-8 "	1¼x2½ " Double Crimp	1 00
" 9	" 135	" 9	1-7 "	1½x3 " " "	1 00
" 9	" 135	" 6	3-16 "	2¼x4½ " " "	90
" 9	" 135	" 3	1-4 "	3 x6 " " "	95
" 9	" 135	" 3	1-4 "	4 x8 " " "	85
" 9	" 135	" 0	5-16 "	4 x8 " " "	1 10
" 10	" 136	" 0	5-16 "	Fancy Designs	1 10
" 11	" 137	" 3	1-4 "	" "	1 10
" 12	" 138	" 3	1-4 "	" "	1 10
" 12	" 138	" 0	5-16 "	" "	1 20
" 13	" 139	" 10	1-8 "	" "	1 10
" 14	" 141	" 10	1-8 "	" "	1 10
" 15	" 140	" 3	1-4 "	" "	1 10
" 16	" 142	" 000	3-8 "	" "	1 35
" 16	" 142	" 0	5-16 "	" "	1 20
" 16	" 142	" 3	1-4 "	" "	1 10

The above Prices include Painting and Bronzing.

Extra charge for Pickets, cast iron, per lineal foot	$ 30	
" " " " wrought iron, per lineal foot	1 25	
" " " Rosettes, per lineal foot	30	
" " " Banding, per square foot	12	
" " " Cast Iron Posts, from	3 00	upwards.
" " " Single Gates, "	6 00	"
" " " Driveway Gates, per pair, from	35 00	"
" " " Scrolls, from	2 00	"

Unusually small pieces and irregular shapes charged extra.

The illustrations referred to in the above list represent various styles of our Ornamental Wire Fences, Etc., for Gardens, Parks, Pleasure Grounds, and all enclosures where an attractive and substantial boundary is required.

These Wire Fences combine beauty, strength and durability, with an airy grace and lightness not attainable in fences of cast iron, wrought iron or wood. Hence, while forming a substantial barrier, they obscure no natural beauty of the grounds enclosed.

This class of Wire Work, long generally used and appreciated in Europe and the East, is becoming justly popular in this country for grounds surrounding private residences, country seats, villas, etc.

When required, a competent man will be sent to measure and give estimates for Fences, Railings, Guards, Store Fronts, and any work in our line.

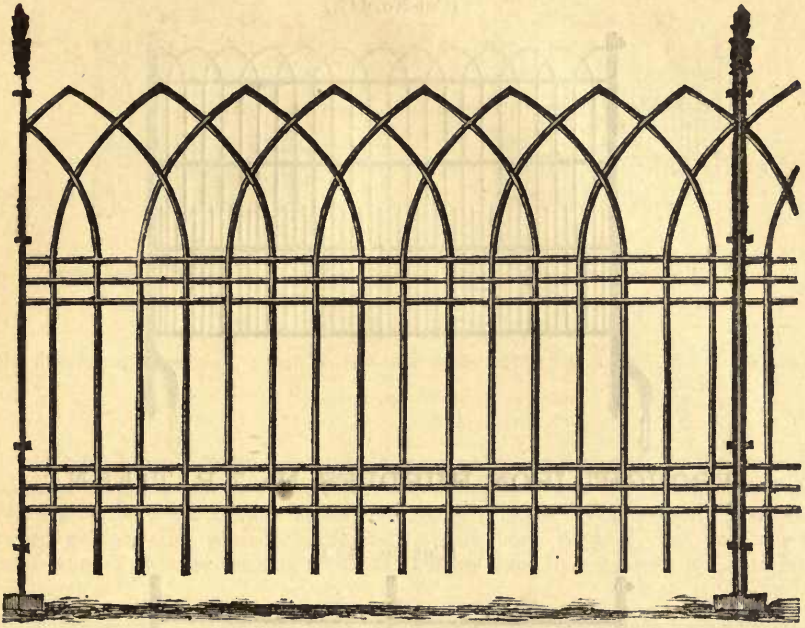
Work made according to any design, and put up when completed, at the lowest possible rates.

Fencing, Railing, Guards, Wire Cloth, etc., galvanized at from 8 to 10 cents per pound.

See useful table of reference, showing the exact size of each number of Wire, from No. 3 to 18, page 72.

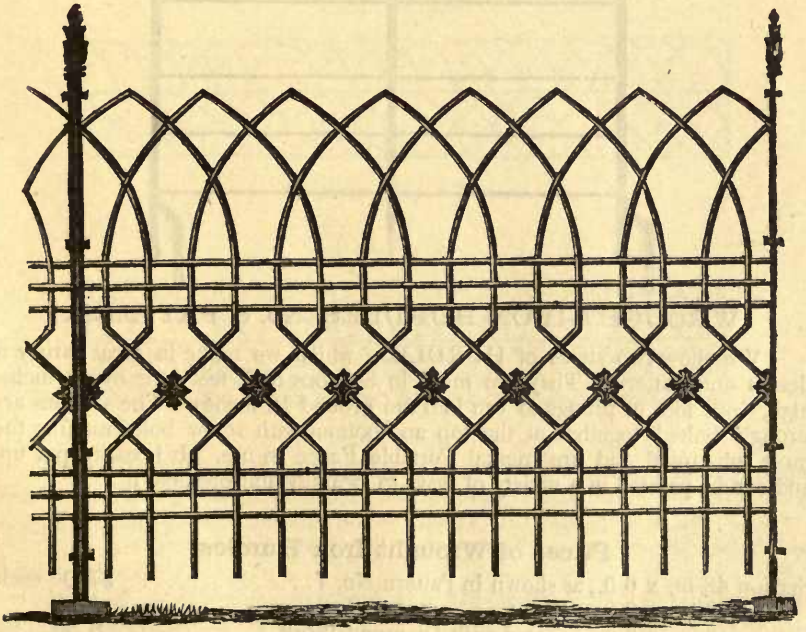
WROUGHT IRON FENCES.

(Cut No. 145.)



No. 18 Pattern, 4 inch spaces, ⅜ inch rods, 3½ feet high, per lineal foot.....$1 75
" " " " " " " 4 " " " " " 2 00

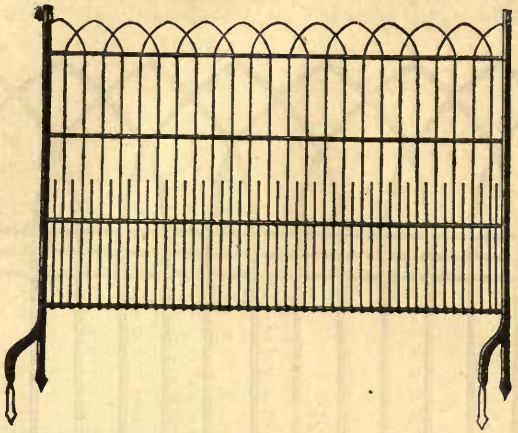
(Cut No. 146.)



No. 19 Pattern, 4 inch spaces, ⅜ inch rods, 3½ feet high, per lineal foot.....$2 25
" " " " " " " 4 " " " " " 2 50

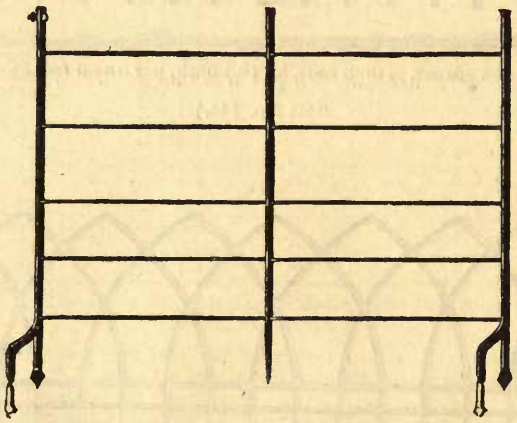
Wrought Iron Hurdle Fences.

(Cut No. 147.)



WROUGHT IRON HURDLES, No. 7 PATTERN.

(Cut No. 148.)



WROUGHT IRON HURDLES, No. 8 PATTERN.

We show two styles of HURDLES, which we make in great variety of design and pattern. They are made in Sections of 6 feet long by 48 inches high, with feet or prongs to run into the ground 12 inches. The sections are strongly bolted together at the top and bottom with screw bolts, making the most substantial and ornamental Portable Fence in use. It is easily put up, and can be painted in a variety of ways to beautify and preserve it.

Prices of Wrought Iron Hurdles.

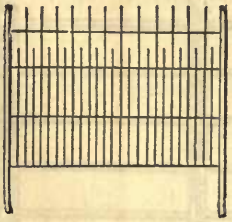
Section 48 in. x 6 ft., as shown in Pattern No. 7	$7 00	each.
" 48 in. x 6 ft., " " " " 8	4 00	"
" 48 in. x 6 ft., covered with Diamond Work	8 50	"

LIGHT LAWN FENCES.

(Cut No. 149.)

Light Lawn Fence, No. 5 Pattern.

(Cut No. 150.)



Light Lawn Fence, No. 6 Pattern.

Price of Light Lawn Fences.

No. 5	Pattern,	3	feet	high,	⅛	inch	wire,	3	inch	space	at the top.....	$1 90 per yard.
" 5	"	4	"	"	"	"	"	"	"	"	.....	2 40 "
" 6	"	3	"	"	"	"	"	"	"	"	.....	1 85 "
" 6	"	4	"	"	"	"	"	"	"	"	.....	2 35 "

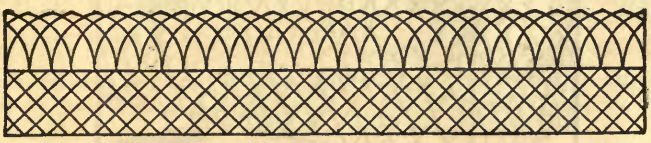
These Lawn Fences are made in continuous lengths, and for the convenience of shipping can be rolled up in the same manner as the Galvanized Twist Netting. They are usually stapled to wooden posts. For a light Fence between gardens and pleasure grounds they are very popular, and very much used when a cheaper fence is required than we show in cuts from No. 1 to No. 18 Pattern.

FENCE AND GARDEN BORDERS.

(Cut No. 151.)

Circle-Top, No. 1 Pattern.

(Cut No. 152.)



Gothic-Top, No. 2 Pattern.

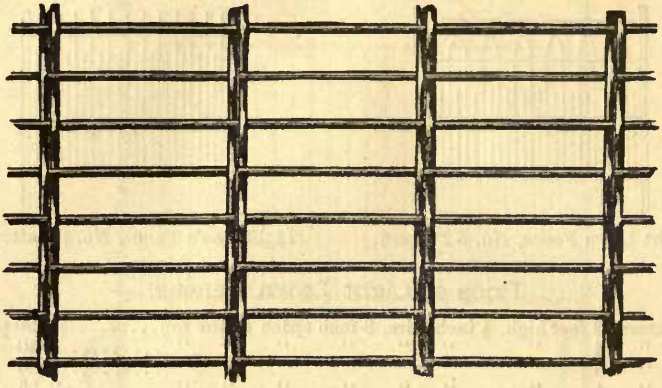
These Wire Borders are secured to the top rail of Garden and Front Fences, and are in extensive demand as an ornamental finish, but particularly as a protection against plant and flower thieves, and vagrant animals.

They are also serviceable for garden walks, croquet grounds and flower bed boundaries.

Made of imperishable galvanized wire, any height, length and design, from 40 cents upward per lineal foot.

WIRE GUARDS, GRAVE ENCLOSURES, Etc.

(Cut No. 153.)



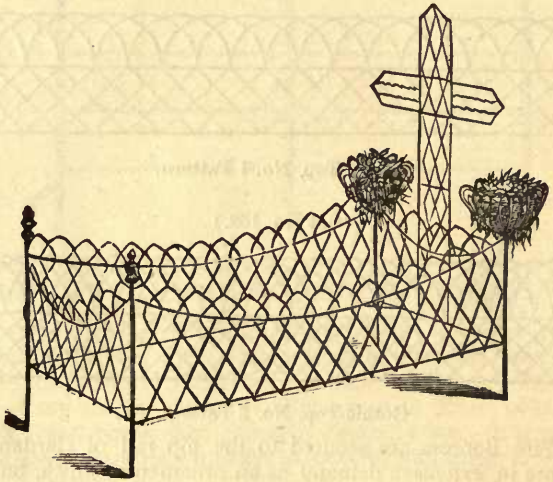
¼ inch by 4 inch Mesh, No. 17 Wire.

Above style of mesh gives same protection to the glass as one-fourth inch square mesh, while it gives three times the space for admission of light. Used for protecting windows in basement, shop, cellar or storehouse.

15 cents per square foot, black wire.
20 cents per square foot, galvanized wire.

GRAVE ENCLOSURES, FENCES, Etc.

(Cut No. 154.)



Price, 3 feet	long,	18	inches	wide			$ 6 50
" 3½	"	21	"	"			8 50
" 4	"	24	"	"			10 00
" 6	"	30	"	"			12 00

Cemetery Fences of various Designs, for which estimates will be given.

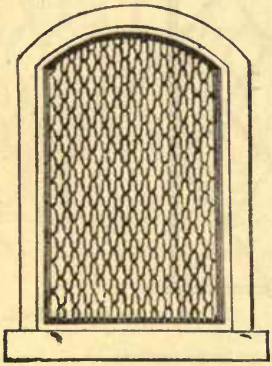
DIAMOND PATTERN

WIRE WINDOW GUARDS

— FOR —

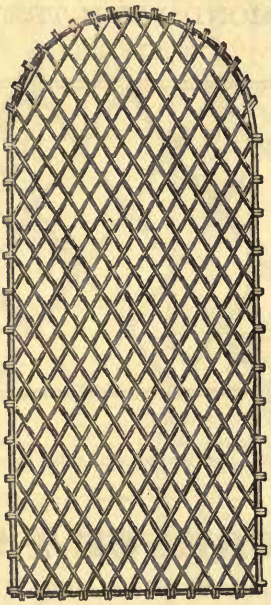
Residences, Warehouses, Public Buildings, Jails, Asylums, Etc.

(Cut No. 155.)



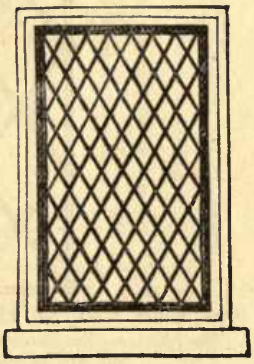
Window Guard, No. 9 Pattern.

(Cut No. 156.)



Window Guard, with Round Top, No. 4 or Diamond Pattern.

(Cut No. 157.)



Window Guard, No. 4 Pattern.

OUR STRONG CRIMPED WIRE GUARDS for skylights, attics, nursery, play-room, basement and all exposed windows, afford secure protection from burglars and breakage, and safety for children, without obstructing light or ventilation.

They furnish better security against unlawful entrance than burglar-alarms or shutters; and being almost invisible at a short distance, present none of the heavy, jail-like appearance of cast or wrought iron guards.

They are screwed or stapled firmly to the window-casings, or made with hinges and locks, or other fastening device, when required to be opened occasionally.

In ordering from a distance, please designate the work desired by reference to Cut and Pattern Nos. in Catalogue, furnish exact measurements, and state whether they are to fasten *between* or *outside* of window-jambs or casings. Curves and irregular outlines are best shown by diagrams or paper patterns.

For Prices, see page 74.

Galvanized Wire Trellis and Lattice Work

— FOR —

Basement and Garden Walls, Division Fences, Porches, Etc.

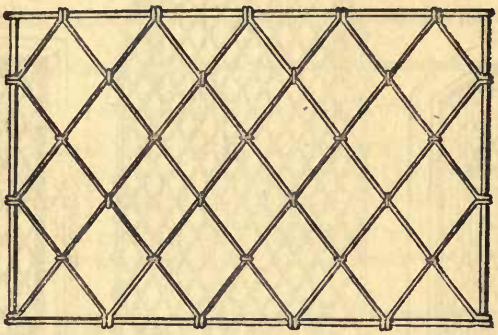
Our Diamond Wire Trellis is in extensive demand where vines and flowers are to be trained on walls, fences, house basements, and blank spaces generally, and is rapidly supplanting the perishable and unsightly wooden lattices.

Being made of Wire heavily galvanized it needs no painting; is entirely unaffected by exposure, and absolutely rust-proof.

This style of Trellis or Lattice is exceedingly congenial to plants and flowers, and affords many of the requisite conditions of rapid and thrifty growth.

DIAMOND WIRE TRELLIS.

(Cut No. 158.)



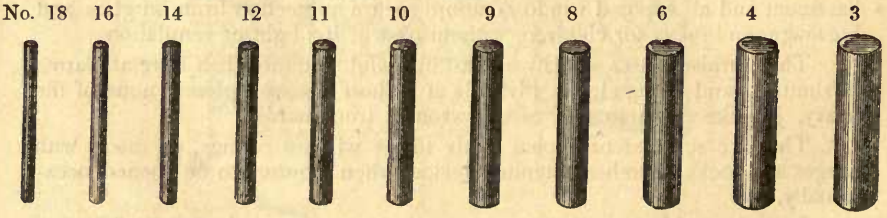
Price, 4 inch Mesh, No. 12 Wire, (put up).....18 cents per square foot.
" " " " 10 " " .....22 " " " "

Any kind made to order and special rates given on large orders.

REFERENCE TABLE,

Showing Full Sizes of Wire and Ultimate Strengths.

TRADE Nos. 3 to 18.



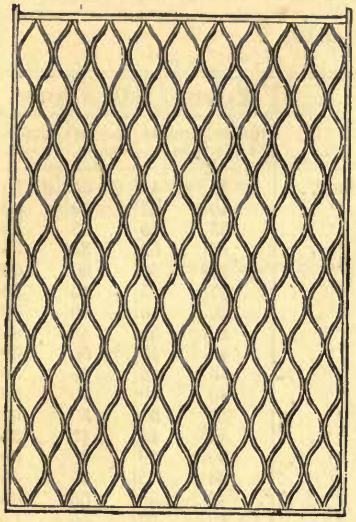
No.	18	16	14	12	11	10	9	8	6	4	3
		1-16 in.	3-32 in.		⅛ in.			5-32 in.	3-16 in.		¼ in.
	160	264	456	800	1000	1280	1560	1840	2510	3620	4250 lbs.

(The above figures show the Breaking Strain.)

The above cuts represent the sizes of Wire most used, which will be convenient to refer to in ordering Springs, Window Guards, Wire Cloth, Wire Fencing, Railing and other Wire Work.

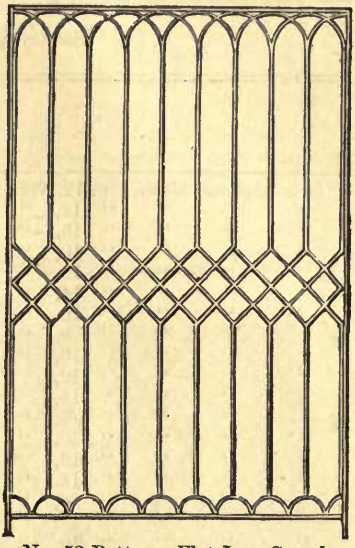
FLAT WROUGHT IRON GUARDS.

(Cut No. 159.)



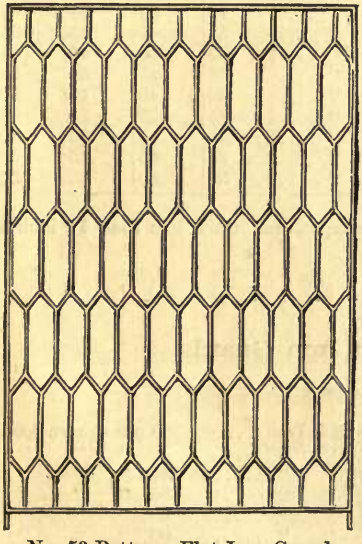
No. 51 Pattern, Flat Iron Guard.

(Cut No. 160.)



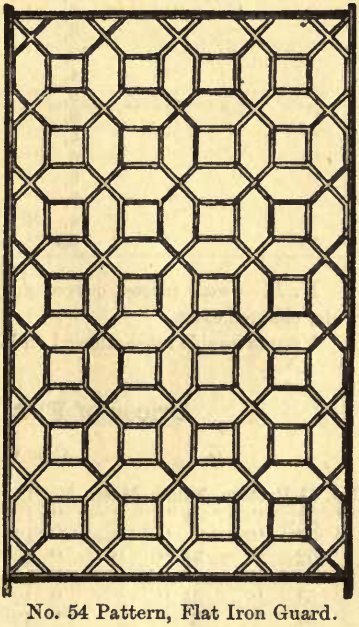
No. 52 Pattern, Flat Iron Guard.

(Cut No. 161.)



No. 53 Pattern, Flat Iron Guard.

(Cut No. 162.)



No. 54 Pattern, Flat Iron Guard.

For Prices, see Opposite Page.

PRICES

— OF —

DIAMOND WIRE WORK.

(See Cuts, Pages 58, 60 and 71.)

										Painted.		Galvanized.	
										Round Frame.	Square Frame.	Round Frame.	Square Frame.
1	inch	Diamond	Mesh,	No.	12,	Wire,	per	square	foot....	$ 45	$ 55	$ 55	$ 65
	"	"	"	"	14,	"	"	"	....	40	50	50	60
	"	"	"	"	16,	"	"	"	....	35	45	45	55
1¼	"	"	"	"	10,	"	"	"	....	45	55	35	65
	"	"	"	"	12,	"	"	"	....	40	50	50	60
	"	"	"	"	14,	"	"	"	....	35	45	45	55
	"	"	"	"	16,	"	"	"	....	30	40	40	50
1½	"	"	"	"	8,	"	"	"	....	45	55	55	65
	"	"	"	"	10,	"	"	"	....	40	50	50	60
	"	"	"	"	12,	"	"	"	....	35	45	45	55
	"	"	"	"	14,	"	"	"	....	30	40	40	50
1¾	"	"	"	"	8,	"	"	"	....	40	50	50	60
	"	"	"	"	10,	"	"	"	....	35	45	45	55
	"	"	"	"	12,	"	"	"	....	30	40	40	50
	"	"	"	"	14,	"	"	"	....	25	35	35	45
2	"	"	"	"	6,	"	"	"	....	45	55	55	65
	"	"	"	"	8,	"	"	"	....	40	50	50	60
	"	"	"	"	10,	"	"	"	....	33	43	43	53
	"	"	"	"	12,	"	"	"	....	26	36	36	46
2½	"	"	"	"	4,	"	"	"	....	45	55	55	65
	"	"	"	"	5,	"	"	"	....	40	50	50	60
	"	"	"	"	6,	"	"	"	....	35	45	45	55
	"	"	"	"	8,	"	"	"	....	30	40	40	50
	"	"	"	"	10,	"	"	"	....	25	35	35	45
3	"	"	"	"	4,	"	"	"	....	40	50	50	60
	"	"	"	"	6,	"	"	"	....	35	45	45	55
	"	"	"	"	8,	"	"	"	....	30	40	40	50
3½	"	"	"	"	4,	"	"	"	....	35	45	45	55
	"	"	"	"	6,	"	"	"	....	30	40	40	50
	"	"	"	"	8,	"	"	"	....	25	35	35	45
4	"	"	"	"	3,	"	"	"	....	40	50	50	60
	"	"	"	"	4,	"	"	"	....	35	45	45	55
	"	"	"	"	6,	"	"	"	....	30	40	40	50

N. B.—Small pieces, curved and irregular shapes, and work less than 18 inches wide, charged extra.

Very favorable rates allowed on large orders.

Prices of Flat Wrought Iron Guards.

(See Cuts, opposite page.)

No.	51	Pattern,	3	inch	Mesh,	No.	12	Gauge,	by	⅝ inch	Iron.....	$ 80	per square foot.
"	51	"	3½	"	"	"	12	"		¾ "	"	80	" " "
"	52	"	3	"	"	"	12	"		⅝ "	"	85	" " "
"	52	"	3½	"	"	"	12	"		¾ "	"	85	" " "
"	53	"	3	"	"	"	12	"		⅝ "	"	90	" " "
"	53	"	3½	"	"	"	12	"		¾ "	"	90	" " "
"	54	"	3	"	"	"	12	"		⅝ "	"	1 00	" " "
"	54	"	3½	"	"	"	12	"		¾ "	"	1 00	" " "

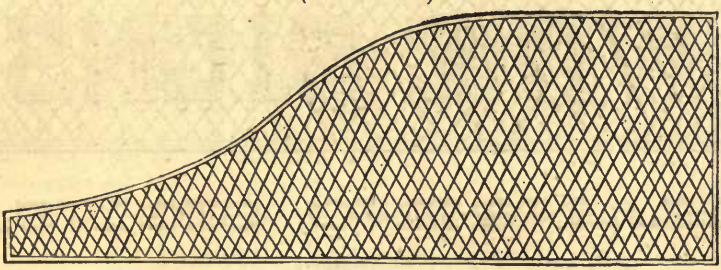
STABLE WIRE WORK,

Stall Partitions, Etc.

ARCHITECTS, BUILDERS, STABLE AND STOCK OWNERS will find this class of our manufactures far superior to similar work of wrought or cast iron, in the essential points of safety, durability and beauty of appearance. The open wire work is strong and elastic, with none of the heaviness and dangerous brittleness of cast iron. Any size made to order, and finished in any color, or galvanized.

No. 1—DIAMOND WIRE WORK STALL GUARD.

(Cut No. 163.)

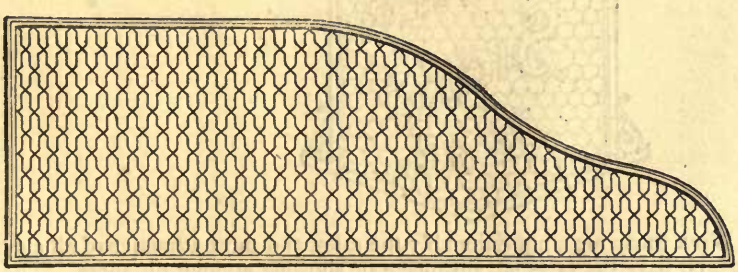


Ordinary sizes, 7 feet to 9 feet 6 inches long, by 30 inches high. Price, 75 cents per square foot, rectangular measurement.

The same work for Box Stalls, 30 inches high, $1.87½ per running foot.

No. 2—DOUBLE CRIMP WIRE WORK STALL GUARD.

(Cut No. 164.)



Price, 85 cents per square foot, rectangular measurement.

Nos. 1 and 2 patterns of Crimped Wire Stall Partitions are made with a substantial wrought iron frame, finished on top with half-oval or corrugated iron covering bar; or to special order, with solid round bar iron, or wrought iron pipe of large diameter, when extra strength and massiveness are desired. The wire is thoroughly interlocked and riveted into the frames, ensuring the utmost strength with beauty and lightness.

Open Wire Work Signs.

(Cut No. 165.)

HANGING SIGNS.

(Cut No. 166.)

WIRE SIGNS are unquestionably the safest and most attractive of all elevated signs, and have the especial advantage of showing at long distances. The letters, numbers, trade emblems, etc. required, are made of galvanized sheet iron, fastened to an open net-work of galvanized wire, thus being proof to all weather action, and offering little surface of resistance, are safe in the strongest winds. They are practically indestructible and unchangeable. The letters, etc., are painted any required color, or gilded. Banner and Roof Signs of any size and design made and put up on the most reasonable terms. Estimates furnished on application.

For Prices, see Page 77.

PRICES

—OF—

Open Wire Work Signs.

(See Cuts, page 76.)

8	feet	long,	6	feet	high	.....	$20 00	10	feet	long,	8 feet high $32 00
10	"	"	7	"	"	.....	30 00	12	"	"	8 " " 38 00
12	"	"	7	"	"	.....	35 00	14	"	"	8 " " 43 00
14	"	"	7	"	"	.....	40 00	14	"	"	9 " " 45 00
16	"	"	7½	"	"	.....	50 00	16	"	"	9 " " 55 00
18	"	"	8	"	"	.....	65 00	18	"	"	10 " " 75 00

The above prices do not include Letters or Ornamentation.

The size and number of Letters required on a Sign will determine its dimensions.

Prices of Letters, etc., are according to size and finish.

12	inch	Letters,	painted	each, $1 00
12	"	"	gold	" 1 75

WIRE WORK BANNER SIGNS.

(As per Cut No. 166.)

36x42 in., with lettering, scrolls, etc., in gold and colors, complete for putting up, $22.

Signs made to order of any size and form, with any required lettering, device or emblem, and put up on the lowest possible terms.

Estimates and drawings furnished.

Comparative Table of Wire Gauges.

For the guidance of those using or requiring Wire for particular purposes, the following table of the different gauges in use may be of advantage:

Nos.	Worcester Diameter.	Trenton Diameter.	Birmingham Diameter.	Brown & Sharp. Diameter.
	Inches.	Inches.	Inches.	Inches.
0	.323	.305	.331	.32486
1	.283	.285	.300	.28930
2	.263	.265	.280	.25763
3	.244	.245	.260	.22942
4	.225	.225	.240	.20431
5	.207	.205	.220	.18194
6	.192	.190	.200	.16202
7	.177	.175	.185	.14428
8	.162	.160	.170	.12849
9	.148	.145	.155	.11443
10	.135	.130	.140	.10189
11	.120	.1175	.125	.09074
12	.105	.105	.110	.08080
13	.091	.0925	.095	.07196
14	.080	.080	.085	.06408
15	.072	.070	.075	.05706
16	.063	.061	.050	.0508
17	.054	.0525	.045	.0452
18	.047	.045	.040	.0403
19	.041	.038	.035	.0359
20	.035	.033	.030	.03196

The Gauge in use at our Works is the Worcester Gauge.

Table showing Size, Weight and Length of Iron Wire (Worcester Gauge).

Gauge Nos.	Diameter Inches.	Area Square inch.	Ultimate Strength in lbs.	Weight of 100 feet. lbs.	Wt. of 1 mile. lbs.	Feet in 63 lbs. Feet.	Feet in 2,000 lbs. Feet.
0000	.393	.121300	9,704	40.94	2163.	154	4,885
000	.362	.102900	8,232	34.73	1834.	181	5,759
00	.331	.086040	6,883	29.04	1533.	217	6,886
0	.323	.081930	6,754	27.66	1460.	228	72,30
1	.283	.062900	5,032	21.23	1121.	296	9,425
2	.263	.054320	4,345	18.34	968.	343	10,905
3	.244	.046759	3,741	15.78	833.	399	12,674
4	.225	.039760	3,181	13.39	707.	470	14,936
5	.207	.033653	2,692	11.35	599.	555	17,621
6	.192	.028952	2,312	9.73	514.	647	20,555
7	.177	.024605	1,968	8.03	439.	759	24,906
8	.162	.020612	1,648	6.96	367.	905	28,734
9	.148	.017203	1,376	5.08	306.	1,086	34,483
10	.135	.014313	1,144	4.83	255.	1,304	41,408
11	.120	.011309	904	3.82	202.	1,649	52,356
12	.105	.008659	693	2.92	154.	2,158	68,493
13	.092	.006647	532	2.24	118.	2,813	89,286
14	.080	.005260	421	1.69	89.	3,728	118,343
15	.072	.004071	328	1.37	72.	4,598	145,985
16	.063	.003117	248	1.05	55.	6,000	190,476
17	.054	.002290	184	.77	41.	8,182	259,740
18	.047	.001734	138	.58	31.	10,862	344,827
19	.041	.001320	105	.45	24.	14,000	444,444
						Ft. in 12 lb	
20	.035	.000963		.32	17.	3,750	625,000
21	.032	.000803		.27	14.	4,444	740,741
22	.028	.000615		.21	11.	5,714	952,381
23	.025	.000491		.17	9.	7,059	1,176,500
24	.023	.000415		.14	7.4	8,571	1,428,580
25	.020	.000314		.11	5.8	10,909	1,818,180
26	.018	.000254		.085	4.5	14,117	2,352,940
27	.017	.000227		.076	4.0	15,790	2,631,580
28	.016	.000201		.067	3.54	17,910	2,986,560
29	.015	.000176		.059	3.11	21,340	3,390,000
30	.014	.000154		.052	2.75	23,080	3,846,150
31	.013	.000133		.045	2.38	26,666	4,444,444
32	.012	.000113		.038	2.00	31,600	5,263,160
33	.011	.000095		.032	1.69	37,500	6,250,000
34	.010	.000078		.026	1.37	46,154	7,692,310
35	.0095	.000071		.024	1.27	50,000	8,333,333
36	.009	.000064		.022	1.16	54,545	9,090,909
37	.0085	.000057		.019	1.03	63,160	10,526,520
38	.008	.000050		.017	.897	70,600	11,764,700
39	.0075	.000044		.015	.792	80,000	13,333,333
40	.00725	.000041		.014	.739	85,715	14,285,710

The strength of the wire in above table is taken at 80,000 lbs. per square inch; and the table of ultimate strength is for hard or bright wire. Annealing or softening reduces the tensile strength about 40 per cent.

The Gauge in use in our Wire Mills is the Worcester Gauge.

When great accuracy is required, the *diameter* should be given.

To convert into weight of other metals, multiply the above for steel, by 1.01; for copper, by 1.15; and for brass, by 1.09.

WATER-PROOF

Cemented Walnut and Rubber

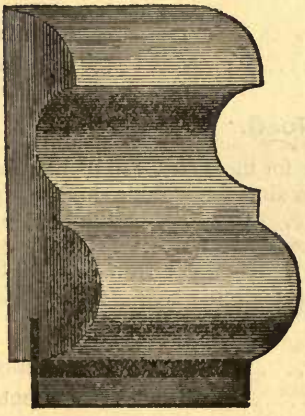
(TORREY'S PATENT)

WEATHER STRIPS.

THE VERY BEST IN USE.

The engravings below represent a short piece of each. They consist of neat Wood Mouldings of Black Walnut and Oak, with a strip of Vulcanized Rubber inserted securely in grooves in such angles and positions as to ensure the greatest efficiency.

(Cut No. 167.)

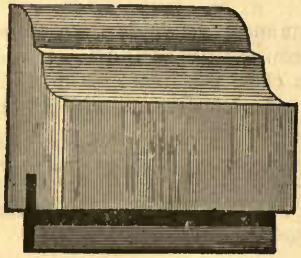


No. 1.

No. 1 thoroughly excludes wind, rain, snow and dust from the bottoms of doors. Close the door and screw the strip to the bottom, *inside*, (or the side the door opens) so that the rubber presses firmly on the sill. Use 1 inch round head screws.

Walnut or Oak, per foot.....12 cents.
White Enameled, " .....15 "

(Cut No. 168.)



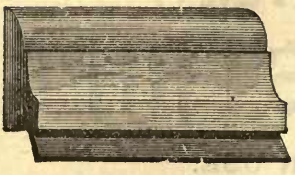
No. 2.

No. 2 is used for the bottoms of light inside doors, the rubber to press gently on the sill. Close door before applying. Use 1¼ inch finishing nails, or 1 inch screws.

Walnut or Oak, per foot.....10 cents.
White Enameled " ..... 15 cents.

TORREY'S PATENT WEATHER STRIPS—Continued.

(Cut No. 169.)



No. 3.

No. 3 is applied to the *lower* sash of lift-windows, making them air-tight and also preventing their *rattling*. Close the sash and brad to the stop bead, at the sides and bottom, so that the rubber will press gently against the sash. For a neat job, mitre the corners. This is also used for *upper* sash by applying it outside. Use ¾ inch brads or finishing nails.

Walnut or Oak, per foot.....5 cents.
White Enameled, " .....7 cents.

(Cut No. 170.)

No. 4.

No. 4 is a perfect arrangement for closing the joints between double doors. Close the doors and nail to one door with the rubber projecting over the other. Use 1¼ inch finishing nails or brads.

Walnut or Oak, per foot.....12 cents.
White Enameled, " .....15 cents.

(Cut No. 171.)

No. 5.

No. 5 is used for the *upper* sash of lift-windows, making them air-tight, and also preventing them from *rattling*. Cut only a little of the meeting rail of the lower sash before applying, so as to allow it to move freely over the No. 5. Close the sash and brad to the parting strip, the rubber pressing gently against the sash. Use ¾ inch brads or finishing nails.

Walnut or Oak, per foot.....5 cents.
White Enameled, " .....7 cents.

(Cut No. 172.)

No. 6.

No. 6 is a neat and effective device for closing the joint between the upper and lower sash of lift-windows, to close the joint between the two sashes. For lift-windows apply to the *under side* of *upper sash*, with rubber projecting over the lower one. Use 1 inch brads or finishing nails.

Walnut or Oak, per foot.....7 cents.
White Enameled, " .....9 cents.

TORREY'S PATENT WEATHER STRIPS—Continued.

(Cut No. 173.)

No. 7. (1 inch wide.)

No. 7 or CUSHION Weather Strip. This is an entirely new and superior arrangement, calculated to supercede all others for the purposes for which it is adapted. Its cushion shape makes it more graceful and elastic, and consequently more effective in its operation than any other form.

It is applicable to single and double doors and *French* windows. Close the door and brad the strips to the jamb or frame outside, so that the cushion rubber presses *very gently* against the door.

Walnut or Oak, per foot..... 8 cents
White Enameled, " .....10 "

No. 8. (1½ inch wide.)

This is also a CUSHION-STRIP. It is used for heavy doors, or when too much warped to admit the use of No. 7.

Walnut or Oak, per foot..... .....12 cents
White Enameled, " .....15 "

(Cut No. 174.)

Spring Bottom Strips, for Outside of Doors, with Rubber Insertion.

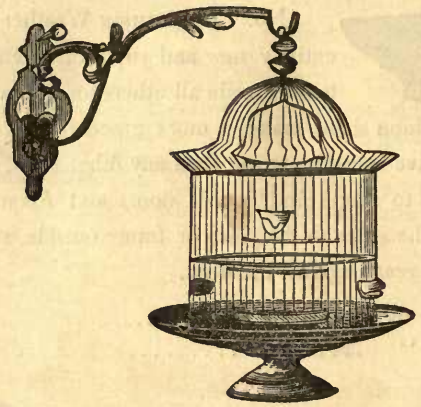
These Strips are well known, being extensively used for the outside of doors. We have made a great improvement in them, by the insertion of a Strip of Rubber in the bottom edge, making them much more effective for excluding the weather. In fitting, cut Strip to width between door jambs, screw on the Strip, and then the striker to the jamb, on opening side.

Price..... .....$1 00 each

HOW TO ESTIMATE QUANTITY REQUIRED.—Measure twice the height, and three times the width of Sash Windows; three times the height and twice the width of French or Hinged Windows; twice the height and one width of Single Doors; three times the height and one width of Double Doors. Add to doors one width of Bottom Strip.

The Directions will enable any one to fix these Strips, or any carpenter can apply them.

Cages and Cage Trimmings.



See Illustrations, Prices, Etc., Pages 83 to 104.

Our stock of Cages is unsurpassed on the Pacific Coast in extent, variety of designs, excellence of manufacture and finish, embracing

BRASS, HOLLAND GILT, GOLD BRONZED, SILVER-PLATED, BRIGHT METAL AND JAPANNED CAGES, OF ALL DESCRIPTIONS.

We have in our warerooms the most approved patterns of

AVIARIES,
CANARY BREEDING,
MOCKING BIRD,
PARROT,
PAROQUET,
QUAIL,
ROBIN,
SQUIRREL CAGES,

And Cages for all purposes, some of which are here illustrated, with prices appended, to which your attention is cordially invited.

Also every kind of Cage Trimmings and Fixtures, wholesale and retail.

Out door Aviaries, Game, Bird and Animal Cages, Etc.

With or without Galvanized Iron Roof, Built to Order any Style and Size.

Estimates and designs furnished. All work made in a superior manner, and put up at the lowest possible rates.

BRASS CAGES.

No. 1100.
SEVEN-INCH
ROUND TOP.
Base, 9½ inches diameter.
Height, 11 inches.
$10.50 per Dozen.

No. 1105.
SEVEN AND ONE-HALF INCH
ROUND TOP.
Base, 10⅝ inches diameter.
Height, 12 inches.
$13.50 per Dozen.

No. 1110.
EIGHT-INCH ROUND TOP.
Base.....11¼ inches diameter.
Height.....13 inches.
$16.50 per Dozen.

No. 1115.
NINE-INCH ROUND TOP.
Base.....12¼ inches diameter.
Height.....14 inches.
$19.50 per Dozen.

No. 1120.
TEN-INCH ROUND TOP.
Base.....13¼ inches diameter.
Height.....15 inches.
$22.50 per dozen.

THE ABOVE CAGES NEST.

Patent Cups and Metal Tipped Perches with the above Cages.

BRASS CAGES—Continued.

No. 00.
SEVEN-INCH ROUND TOP.
Base, 9½ inches diameter.
Height, 14 inches.
$12.00 Per Dozen.

No. 000.
SEVEN AND ONE-HALF-INCH ROUND TOP.
Base, 10⅝ inches diameter.
Height, 16 inches.
$18.00 Per Dozen.

No. 200.
EIGHT-INCH ROUND TOP.
Base.....11¼ inches diameter.
Height.....16½ inches.
$21.00 Per Dozen.

No. 205.
NINE-INCH ROUND TOP.
Base.....12¼ inches diameter.
Height.....18 inches.
$26.00 Per Dozen.

No. 210.
TEN-INCH ROUND TOP.
Base.....13¼ inches diameter.
Height.....19 inches.
$30.00 Per Dozen.

THE ABOVE CAGES NEST.

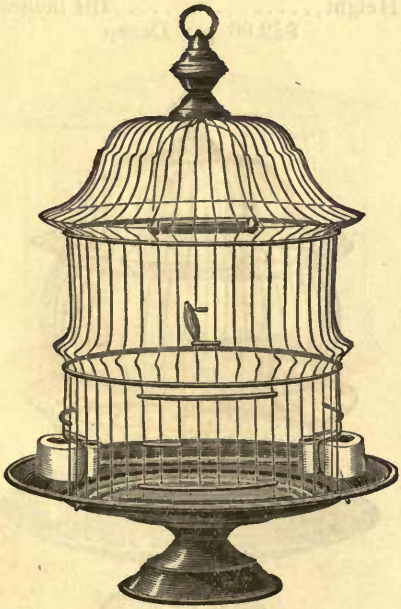
Patent Cups and Metal Tipped Perches with the above Cages.

UNIVERSITY OF CALIFORNIA

BRASS CAGES—Continued.

No. 202.
EIGHT-INCH DIAMETER.
Base.....11¼ inches diameter.
Height.....17 inches
$22.50 Per Dozen.

No. 215.
NINE-INCH JAPANESE.
Base.....12¼ inches diameter.
Height.....19 inches.
$30.00 Per Dozen.

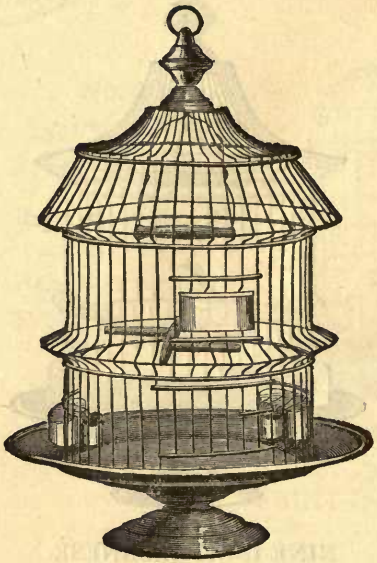


No. 216.
NINE-INCH FANCY.
Base.....12¼ inches diameter.
Height.....18 inches.
$30.00 Per Dozen.

No. 220.
TEN-INCH JAPANESE.
Base.....13¼ inches diameter.
Height .....19½ inches.
$36.00 Per Dozen.

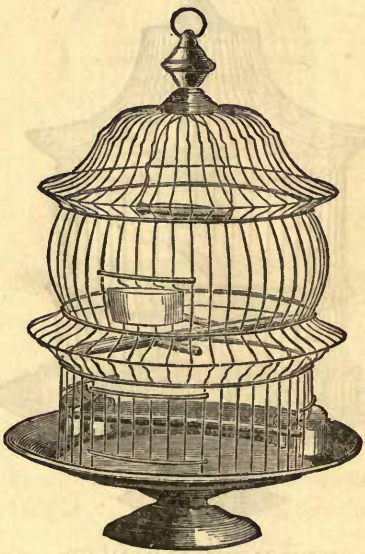
Patent Cups and Metal Tipped Perches with the above Cages.

BRASS CAGES.—Continued.

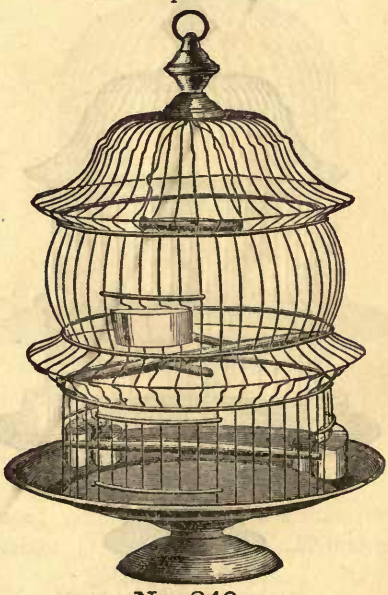


No. 225.
NINE-INCH MANSARD.
Base.....12¼ inches diameter.
Height.....19 inches.
$39.00 per Dozen.

No. 230.
TEN-INCH MANSARD.
Base.....13¼ inches diameter.
Height.....19½ inches.
$42.00 per Dozen.



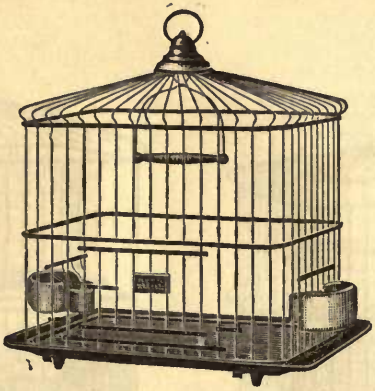
No. 235.
NINE-INCH BALLOON.
Base.....12¼ inches diameter.
Height.....19 inches.
$39 00 per Dozen.



No. 240.
TEN-INCH BALLOON.
Base.....13¼ inches diameter.
Height.....19½ inches.
$42.00 Per Dozen.

Patent Cups and Metal Tipped Perches with the above Cages.

BRASS CAGES—Continued.

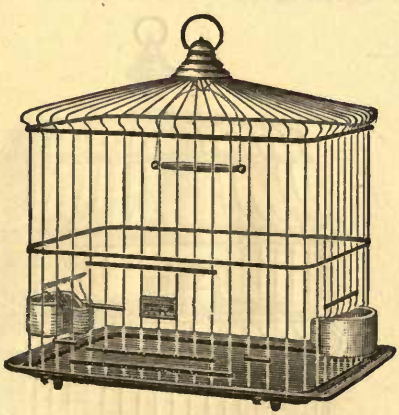


No. 1200.

SQUARE.

Body.....9½ x 6½ inches.
Base.....11½ x 8½ inches.
Height.....12½ inches.

$21.00 Per Dozen.

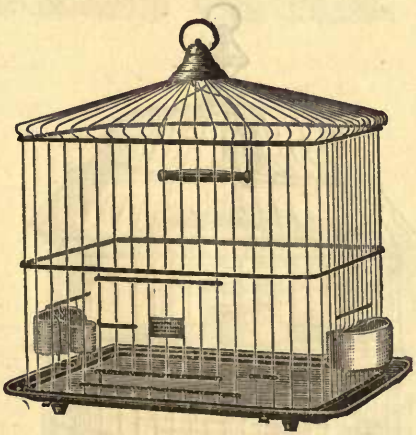


No. 1205.

SQUARE.

Body.....10¼x7¼ inches.
Base.....12¼x9¼ inches.
Height.....12½ inches.

$24.00 Per Dozen.



No. 1215.

SQUARE.

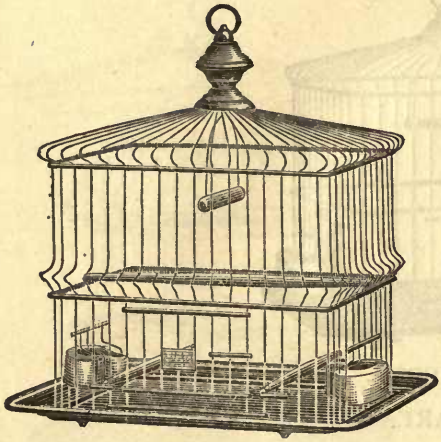
Body.....10¾x7¾ inches.
Base.....12¾x9¾ inches.
Height.....13½ inches.

$27.00 Per Dozen.

THE ABOVE CAGES NEST.

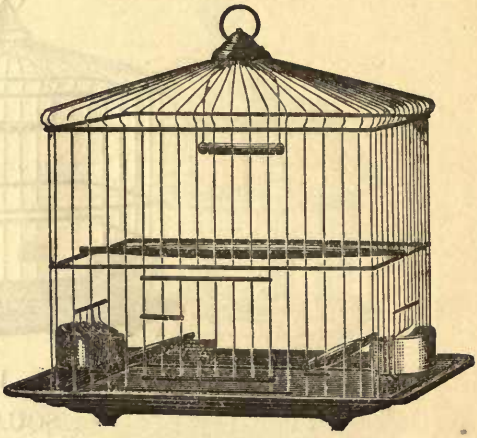
Patent Cups and Metal Tipped Perches with the above Cages.

BRASS CAGES.—Continued.



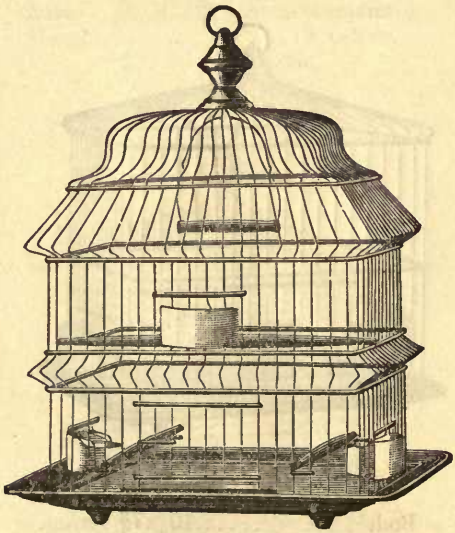
No. 300. SQUARE.

Body.....10¾x8½ inches.
Base.....13¼x11¼ inches.
Height.....15 inches.
$39.00 Per Dozen.



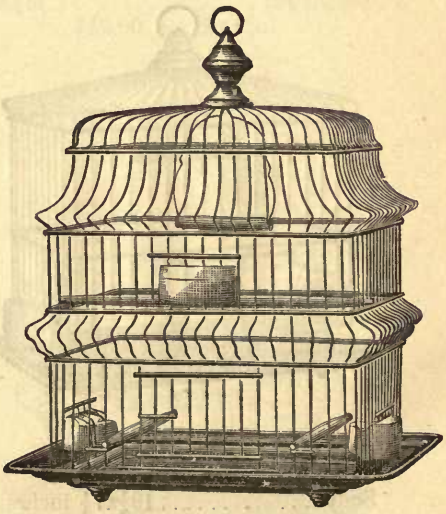
No. 301. SQUARE.

Body.....10¾x8½ inches.
Base.....13¾x11¼ inches.
Height.....14 inches.
$30.00 Per Dozen.



No. 305. SQUARE

Body.....10¾x8½ inches.
Base.....13¼x11¼ inches.
Height.....18 inches.
$51.00 Per Dozen.

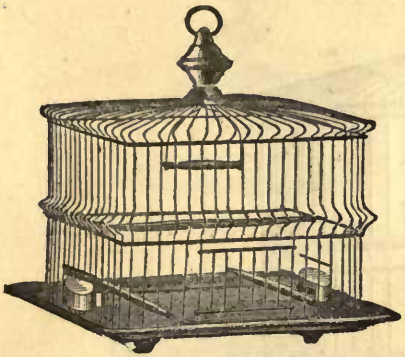


No. 310. SQUARE.

Body.....10¾x8½ inches.
Base.....13¼x11¼ inches.
Height.....18 inches.
$51.00 Per Dozen.

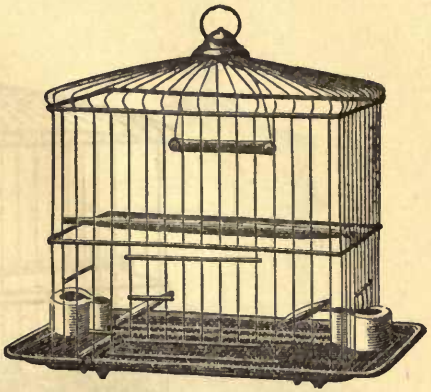
Patent Cups and Metal Tipped Perches with the above Cages.

BRASS CAGES.—Continued.



No. 315. SQUARE.

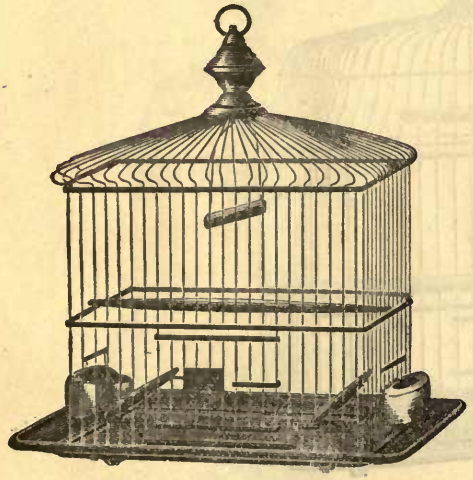
Body.....9½x7 inches.
Base.....12½x10 inches.
Height.....14¼ inches.
$30.00 Per Dozen.



No. 316. SQUARE.

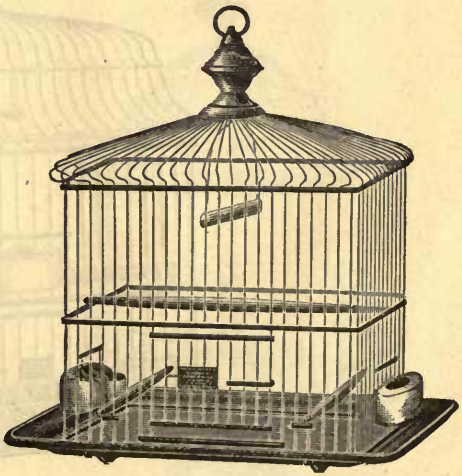
Body.....9½x7 inches.
Base.....12½x10 inches.
Height.....12½ inches.
$26.00 Per Dozen.

CLOSE WIRE BRASS CAGES.



No. 320. SQUARE.

80 Wires—5-16 inch space. Same size as No. 300.
$42.00 Per Dozen.

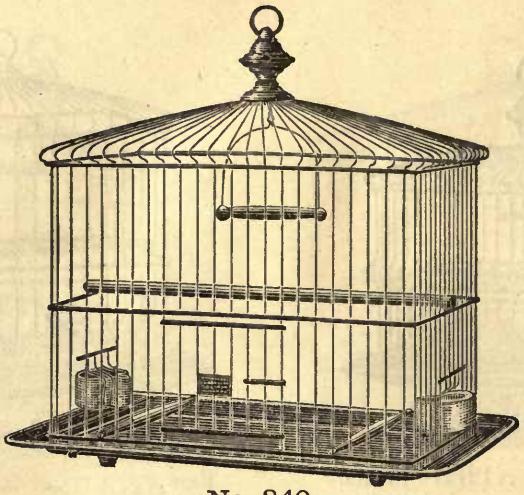


No. 325. SQUARE.

64 Wires—5-16 inch space. Same size as No. 315.
$39.00 Per Dozen.

Patent Cups and Metal Tipped Perches with the above Cages.

BRASS CAGES—Continued.

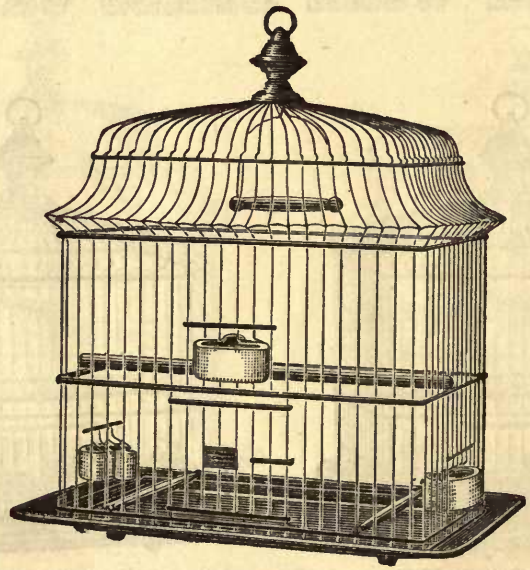


No. 340.

SQUARE.

Body ..... 13 x 8½ inches.
Base ..... 15¼ x 11½ inches.
Height ..... 16 inches.

$45.00 Per Dozen.



No. 345.

SQUARE.

Body ..... 13 x 8½ inches.
Base ..... 15¾ x 11½ inches.
Height ..... 19 inches.

$51.00 Per Dozen.

Patent Cups and Metal Tipped Perches with the above Cages.

BRASS CAGES.—Continued.

No. 1. CANARY.

Body.....7¾ inches.
Base.....10¾ inches.
Height.....15½ inches.
$21.00 Per Dozen.

No. 2. CANARY.

Body.....7¾ inches.
Base.....10¾ inches.
Height.....15½ inches.
$24.00 Per Dozen.

No. 3. CANARY.

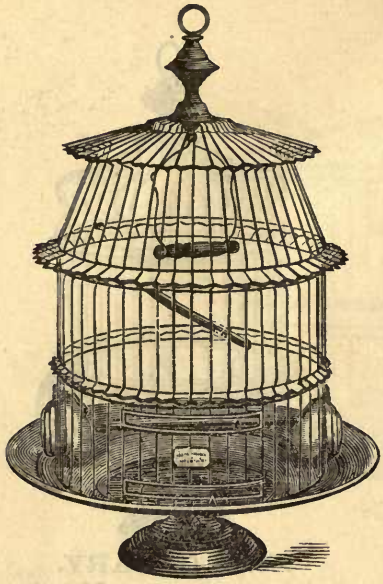
Body.....8½ inches.
Base.....12 inches.
Height.....16½ inches.
$27.00 Per Dozen.

No. 4. CANARY.

Body.....8½ inches.
Base.....12 inches.
Height.....16½ inches.
$30.00 per Dozen.

Patent Cups and Metal Tipped Perches with the above Cages.

BRASS CAGES—Continued.



No. 9. CANARY.

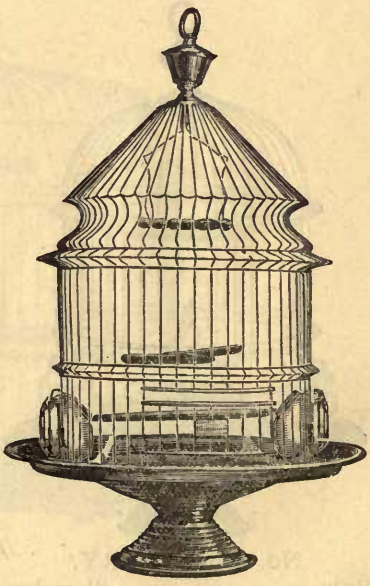
Body.....10 inches.
Base.....13½ inches.
Height.....20 inches.
$54.00 Per Dozen.

No. 10. CANARY.

Body.....10 inches.
Base.....13½ inches.
Height.....20 inches.
$54.00 Per Dozen.

No. 11. CANARY.

Body.....10 inches.
Base.....13½ inches.
Height.....21 inches.
$57.00 Per Dozen.



No. 12. CANARY.

Body.....10 inches.
Base.....13½ inches.
Height.....21 inches.
$60.00 Per Dozen.

Patent Cups and Metal Tipped Perches with the above Cages.

BRASS CAGES.—Continued.

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No. 40. CANARY.

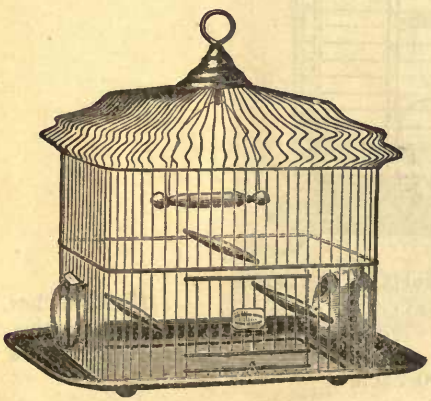
Body.....8x9 inches.
Base.....11x13 inches.
Height.....11¾ inches.
$36.00 Per Dozen.

No. 45. CANARY.

Body.....9½x12 inches.
Base.....11¾x14¼ inches.
Height.....13½ inches.
$57.00 Per Dozen.

CLOSE WIRE BRASS CAGES.

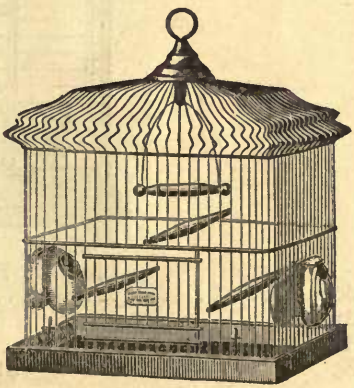
NEW DESIGN.



No. 47. CANARY.

Body.....9x11 inches.
Base.....11x13 inches.
Height.....13½ inches.
$51.00 Per Dozen.

NEW DESIGN.

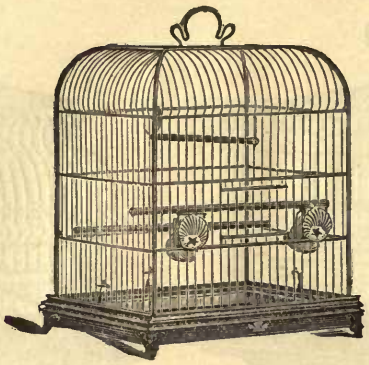


No. 48. CANARY.

Body.....9x11 inches.
Height.....13 inches.
With Drawer Base.
$54.00 Per Dozen.

Patent Cups and Metal Tipped Perches with the above Cages.

BRASS CAGES.—Continued.



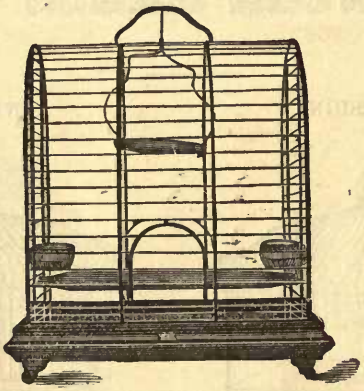
No. 62. PAROQUET.

Body	13¾x11 inches.
Base	12x17¾ inches.
Height	16½ inches.
Price	$7.75 each

MATERIAL:

Frame Work	Fancy Brass Tube.
Filling Wires	Brass Spring Wire.
Base	Black Walnut, Oil Finish

A Drawer in this Cage.



No. 74. PARROT CAGE.

Body	15x22 inches.
Base	17x24 inches.
Height	22 inches.

$11.00 Each.

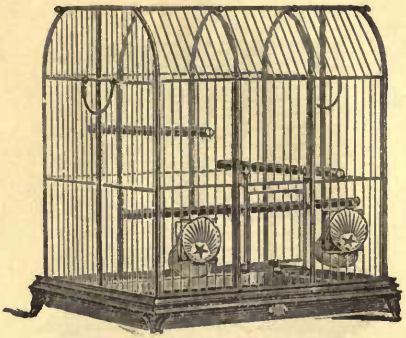
No. 75. PARROT CAGE.

Body	15x18 inches.
Base	17x20 inches.
Height	22 inches.

$10.00 Each.

MATERIAL: Fancy Brass Tube, Eng. Tinned Wire, Black Walnut Base.

MOCKING BIRD CAGES.



LIBRARY OF THE UNIVERSITY OF CALIFORNIA

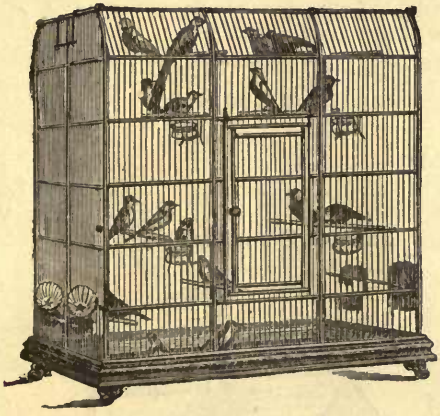
No. 70. LARGE SIZE MOCKING BIRD.

Body.....14½x23½ inches.	Height.....23½ inches.
Base.....16½x25½ inches.	Price.....$10.00 Each.

No. 71. SECOND SIZE MOCKING BIRD.

Body.....14½x20 inches.	MATERIAL:
Height.....21½ inches.	Frame Work.....Fancy Brass Tube.
Base.....16½x22 inches.	Filling Wire.....English Tinned Wire.
Price.....$9.00 each.	Base.....Black Walnut, Oil Finish.

AVIARIES.



No. 81. AVIARY.

Body Measure.

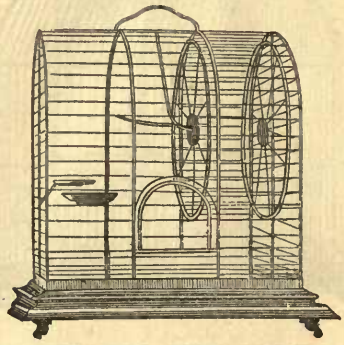
Height.....27 inches.	Length.....23½ inches.
Width.....14½ inches.	Price, Each.....$18.00.

Will accomodate 20 to 30 Birds.

MATERIAL.

Spring Brass Wire and Fancy Brass-Tube Bodies, Black Walnut Bases, Oil Finish.
A Drawer in these Cages.

SQUIRREL CAGES.



No. 64. GRAY SQUIRREL.

Body ..... 15x18 inches.
Wheel ..... 14 inches.
Full Height ..... 23 inches.

$10.00 Each.

No. 65. RED SQUIRREL.

Body ..... 13x15 inches.
Wheel ..... 11 inches.
Full Height ..... 19 inches.
Base ..... 15x20 inches.

$9.00 Each.

No. 68. DOUBLE RED.

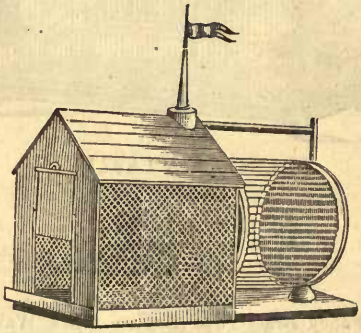
Body ..... 13x18 inches.
Two Wheels .....
Full Height ..... 19 inches.
Base ..... 15x20 inches.

$12.00 Each.

MATERIAL.

Frame Work of Body ..... Fancy Brass Tube.
Filling Wire ..... English Tin'd Wire.
Bases ..... Black Walnut, Oil Finish.

Pan and Grating in these Cages.

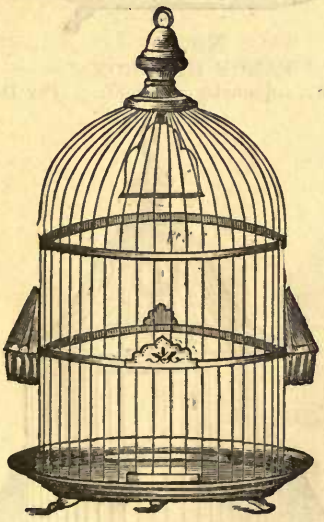


SQUIRREL AND MOUSE CAGES.

JAPANNED CAGES.

No. 1.
ROUND TOP.

Flat Base..... .....7½ inches diameter.
Height..... .....16 inches.



No. 2.
ROUND TOP.

Flat Base.....8¼ inches diameter.
Height.....17 inches.

No. 3.
ROUND TOP.

Flat Base.....8¾ inches diameter.
Height.....17½ inches.

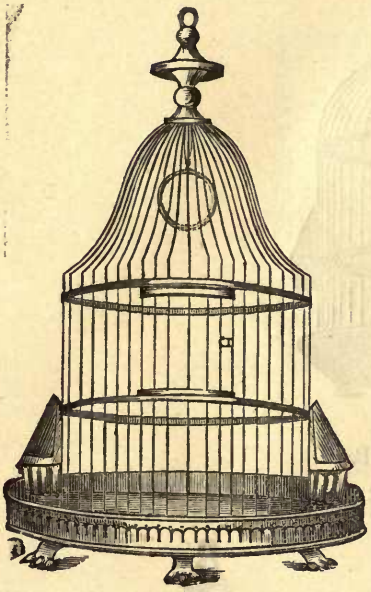
No. 4, (same pattern as above) Round Top, Flat Base, 9½ inches diameter.
No. 5, " " " " " " 10½ " "

These Cages are sold only in Nests of Five.

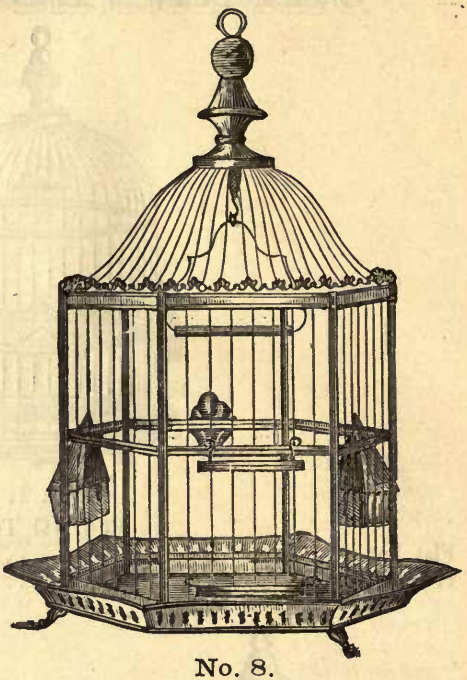
Price per Nest, (Nos. 1, 2, 3, 4 and 5).....$4.00

NOTE.—The above Cages are packed in Nests ready for shipping, with trimmings inside.

JAPANNED CAGES.—Continued.

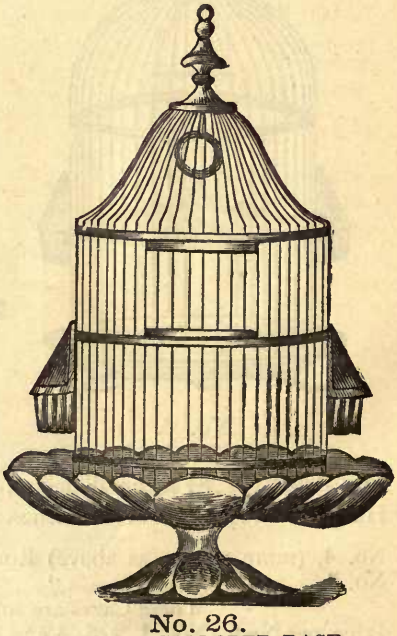


No 4.
FANCY ROUND, FLAT BASE.
8½ inches..diameter | $12.00 Per Dozen.
No. 7, same design) 9 in. dia., $15.75 Per Dozen.



No. 8.
FANCY HEXAGON.
8½ inches....diameter. | $18.00.....Per Dozen.

No. 14.
HEXAGON, STAND BASE.
8½ in..diameter. | $23.50..Per Doz.



No. 26.
ROUND, SCOLLOPED BASE.
9 in.....diameter | $16.25..Per Dozen.

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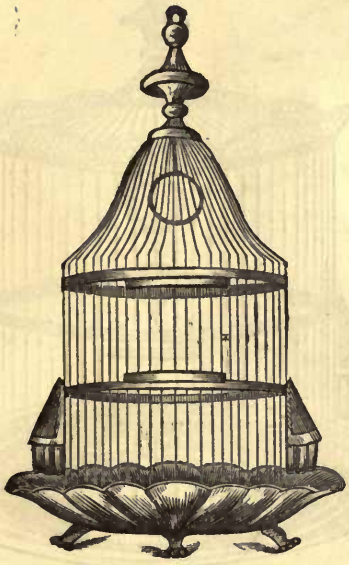
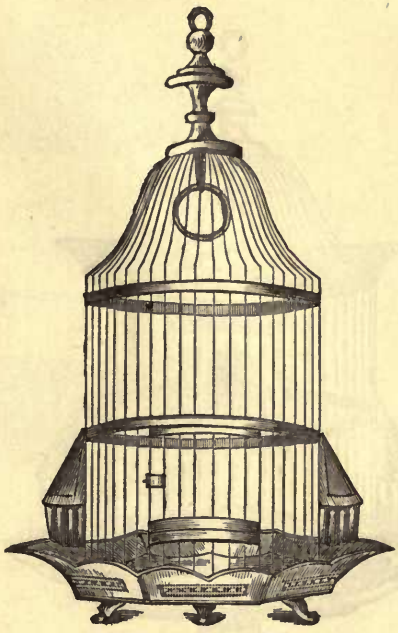
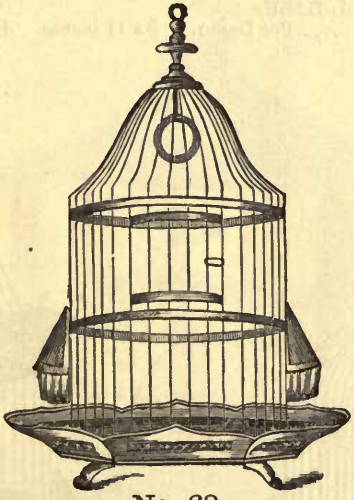
JAPANNED CAGES.—Continued.



No. 27.
ROUND, SCOLLOPED BASE.
8½ in...diameter. | $13.25..Per Doz.



No. 64.
ROUND, HEXAGON BASE.
9 in.....diameter | $15 75...Per Dozen.



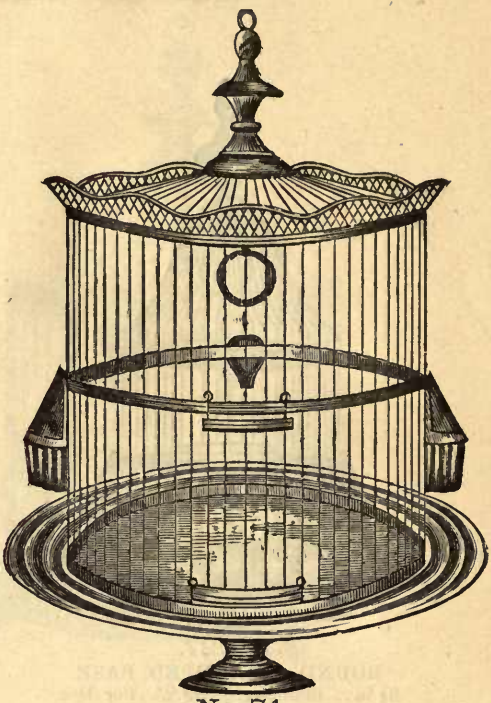
No. 63.
ROUND, HEXAGON BASE.
8½ in....diameter. | $13.75.Per Dozen.

No. 63, with this Base. $14.50 Per Doz.

No. 64, with this Base, $16.25 Per Doz.

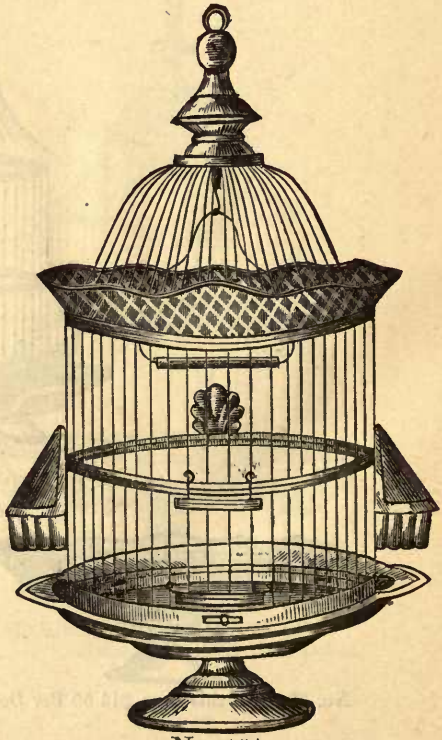
JAPANNED CAGES.—Continued.

No. 28.
ROUND, FANCY, BELL BASE.
9 inches.....diameter. | $16.25.....Per Dozen.



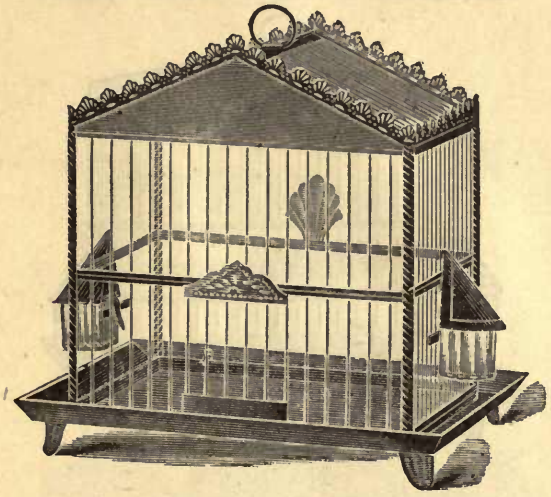
No. 74
OVAL, FANCY.
9 x 11 inches...diameter. | $21.75.....Per Dozen.

No. 84.
HEXAGON, FLAT BASE.
8½ inches.....diameter | $16.25 .....Per Dozen.



No. 88.
ROUND, FANCY BASE.
9 inches..... | $22.75.....Per Dozen.

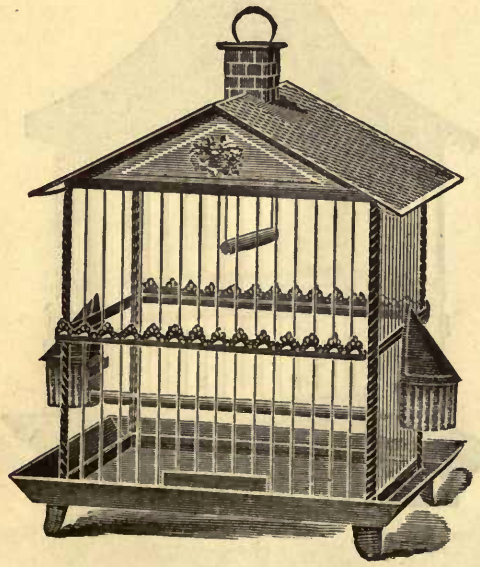
JAPANNED CAGES—Continued.



No. 39.

Extra Fancy Open Square. 10½ x 7½ in. Height, 16 in.

$20.00 Per Dozen.

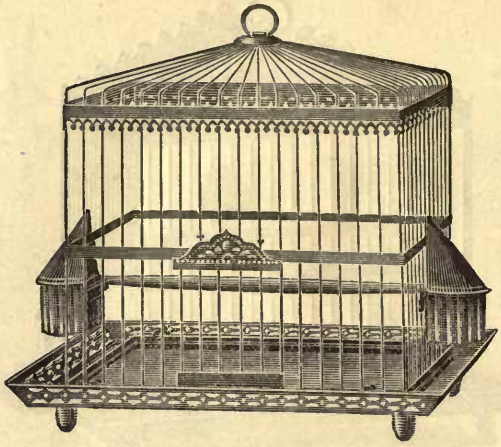


No. 44.

Cottage with Perforated Roof. 10½ x 7½ in. Height. 15 in.

$24.00 Per Dozen.

JAPANNED CAGE—Continued.



No. 72.

New Style Square. Two Sizes.

10½ x 7½ in. Height, 14 in. 10 x 7 in. Height, 13 in.

Sold in nests only. $13.00 Per Dozen.

89½.

Swiss Cottage, Plain.

10 x 7 in. Height, 16½ in.

$18.00 Per Dozen.

JAPANNED CAGES.—Continued.

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No. 78.
New Style. Fancy Square.
10½ x 7½ in. Height, 16 in.
$18.00 Per Dozen.

No. 100.
New Style.
Fancy Square
O. G. Cottage

10½ x 7½ in.
Height, 19 in.
$25.00
Per Dozen.

Price List of Cage Fixtures, Etc.

CAGE BRACKETS.

Harp Brackets, No. 5, Japanned	$1 25	Per Dozen.
" " 10, "	1 50	"
Patent O. D. Brackets, Nos. 5 and 6	2 50	"
" " " 3 " 4, Brass	3 00	"

CAGE SUNDRIES.

Colored Awnings, Nos. 1 and 2, Round	$6 75	Per Dozen.
" " No. 3, Square	7 50	"
Brass Chains, with Safety Hooks, 24 inch	1 25	"
Brass Cage Springs, with Safety Hooks	1 75	"
Bath Cups, China, two sizes (oval)	1 00	"
" Opal, " " Canary	1 00	"
" for Mocking Birds, China	2 75	"
Feed Cups, China, small	50	"
" for Mocking Birds, round, 2 sizes	1 00	"
" " Japanned Cages	1 00	"
Feed Bottles, Glass, for Wooden Cages	75	"
Birds' Nests, Willow	75	"
" " Wire	75	"
Star Mocking Bird Cups (patented)	3 60	"
" Canary " " "	2 40	"
Monogram Cups	1 50	"
Occident Cup (can be used in nearly all Cages)	1 25	"
Aldom's Patent Spring Perch	2 00	"
Tapered Cedar Perches, ferruled ends	75	"
Brass Charm Bells	3 50	Per Gross.
Cuttle Fish Holders	6 00	"
Brass Guard Cloth, 3½ inches wide	20 cents	Per Lineal Foot.
" " " 5 " "	25 "	" "
Singer's Patent Gravel Paper	$2 50	Per Dozen Packages.

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PRICE LIST

—OF—

COPPER WIRE CLOTH.

No length less than 100 feet shall be understood to be a Roll.

The Mesh in Wire Cloth is the distance from the Center to the Center of the Wire.

No.	2	Mesh	Copper	Wire	Cloth,	made	from	No.	16	Wire, per sq. ft. 65 cents.
"	3	"	"	"	"	"	"	17	"	" 65 "
"	4	"	"	"	"	"	"	18	"	" 65 "
"	5	"	"	"	"	"	"	19	"	" 65 "
"	6	"	"	"	"	"	"	20	"	" 65 "
"	8	"	"	"	"	"	"	22	"	" 65 "
"	10	"	"	"	"	"	"	23	"	" 65 "
"	12	"	"	"	"	"	"	24	"	" 65 "
"	14	"	"	"	"	"	"	25	"	" 65 "
"	16	"	"	"	"	"	"	26	"	" 65 "
"	18	"	"	"	"	"	"	27	"	" 65 "
"	20	"	"	"	"	"	"	28	"	" 65 "
"	22	"	"	"	"	"	"	29	"	" 65 "
"	24	"	"	"	"	"	"	30	"	" 65 "

Full Rolls, (of any width desired) made to order at short notice; shorter lengths at slight additional cost.

TWILLED BRASS OR COPPER WIRE CLOTH.

All meshes 10 cents per square foot advance on price of plain cloth.

BRASS WIRE CLOTH FOR SUGAR MILLS.

No. 120 Mesh German, wove to size Nos. 27 and 33 Wire, $1.25 per square foot.

WINE BOTTLE RACKS.

We manufacture Wine Bottle Racks, or Bins, of all capacities, from 12 dozen upwards, and of form and dimensions to suit any allotted space.

These Wine Racks are constructed of corrugated iron rods, rivetted into wrought iron frame work, and are much superior to woodwork in cleanliness, durability and portability.

We invite your attention to our

IMPROVED LOCK UP WINE RACKS.

Which are enclosed with a strong wire net work, and with Gates that lock securely, thus affording a most efficient guard against domestic pilfering and other sources of loss.

PRICES OF OPEN WIRE RACKS.

Single Tier, (capacity, 12 Dozen and over).....$ Per Doz. Bottles.
Double Tier, " 24 " " " ..... " " "

PRICES OF LOCK UP WINE RACKS.

Double Tier, (capacity, 24 Dozen and over).....$ Per Doz. Bottles.
Estimates for any size furnished on application.

Adjustible Music Stands.....$3.00 Each.
Paragon Fly Traps.....$4 00 Per Doz.
Balloon " " ..... 3 50 " "
Lustral Wire Photograph Racks..... 6 00 " "
" " Card Racks..... 9 00 " "

SHERWOOD'S LUSTRAL WIRE GOODS.

We have a large assortment of White Lustral Wire Goods, comprising Broilers, Dish Stands, Cake Baskets, Moss Baskets, Waste Paper Racks, Brush and Sponge Holders, etc., and numberless useful articles for Toilet, Dining-Room, Kitchen and Culinary uses, at manufacturers' prices.

☞City Visitors, Country Dealers, and others, are cordially invited to inspect the Extensive Stock of Wire Manufactures in our Warerooms.

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BERKELEY

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